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ICU Nurses Knowledge of Radiation Safety and Their Behaviours Towards Portable Radiological Examinations

By

MR.SIKENDER KUMAR

M.sc in Medical Imaging Technology

Enrolment no- (950122474)

DEPARTMENT OF RADIO-DIAGNOSIS

SANTOSH DEEMED TO BE UNIVERSITY

NO. 1, SANTOSH NAGAR, GHAZIABAD-201009,

DELHI NCR, INDIA

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GUIDE: **Name: Miss Neelam Rao Bharti**

Designation: Assistant professor

Department: Radio-diagnosis imaging Technology

Santosh Deemed to be University, Ghaziabad-201009

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CERTIFICATE BY THE CO-GUIDE

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CO-GUIDE: **Name: Mr. Himanshu Mishra**
Designation: Assistant professor
Department: Radio-diagnosis imaging Technology
Santosh Deemed to be University, Ghaziabad-201009

CERTIFICATE BY THE HEAD OF DEPARTMENT

This is to certify that the dissertation title **"ICU Nurses Knowledge of Radiation Safety and Their Behaviors Towards Portable Radiological Examinations"** being submitted by Sikender kumar in partial fulfilment of the requirement for the degree **of M.Sc Medical Imaging Technology** is based on the bonafide work carried out by him in department of Department of Radio-Imaging Technology, Santosh Deemed to be University, Ghaziabad, (U.P)

Name: Dr. Ashok Kumar Sharma

Designation: Professor and HOD of Department

Department: Department of Radio-diagnosis

Santosh Deemed to be University,

Ghaziabad-201009

SANTOSH
Deemed to be University

ENDORSEMENT BY DEAN ACADEMICS OF THE UNIVERSITY

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Dr Shalabh Gupta

MBBS, MS

Dean Academics

Santosh Deemed to be University,

Ghaziabad-201009

STATISTICIAN CERTIFICATE

This is to certify that the statistical analysis component of the thesis titled "**ICU Nurses Knowledge of Radiation Safety and Their Behaviors Towards Portable Radiological Examinations**"done by **Dr. Amod Singh** in the **Department of Community Medicine** at Santosh Medical Collage and Hospital, Ghaziabad, has been conducted under my direct guidance and supervision.

All the statistical calculations of the study are authentic and correct to the best of my knowledge.

Name: Dr. Amod Singh

Designation: Assistant professor and Bio-statistician

Department of Community Medicine

Santosh Deemed to be university,

Ghaziabad- 201009

SANTOSH
Deemed to be University

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ABSTRACT

Background: ICUs pose significant challenges for radiation security due to the constant use of small X-ray machines, small spaces, and the general state of patients, which complicates standard safety protocols. It is imperative that ICU nurses understand radiation security because they play a critical role in assisting radiographers, positioning patients, and occasionally operating X-ray equipment. Studies have revealed significant gaps in the knowledge of radiation safety among non-radiology personnel, such as ICU medical attendants, and have linked these information gaps to inadequate security drills. Lack of awareness regarding radiation safety can cause unnecessary anxiety in medical staff, which could impact patient care. Guidelines govern the use of ionizing radiation in many countries, but research indicates that medical professionals lack comprehensive radiation training,

Objective: This study aims to evaluate the attitudes of ICU nurses toward portable radiological examinations and their knowledge of radiation safety. Through assessing their comprehension of radiation hazards and safety procedures, we hope to find any possible knowledge gaps and provide guidance for focused training initiatives. The study will also investigate how these variables affect their procedures for portable imaging, which will ultimately improve patient safety and care in demanding settings.

Methods: A sample of 98 ICU nurses at Santosh Deemed to be University participated in this cross-sectional study, which examined their attitudes toward radiation safety and how they conducted portable radiological exams. A structured questionnaire intended to evaluate knowledge of radiation effects, safety precautions, and regulatory guidelines will be used to gather data. A checklist of observations will also be used to assess how nurses actually behave during X-ray procedures, including how they utilize safety equipment, follow safety procedures, and interact with radiographers. The goal of this dual approach is to give a thorough grasp of both knowledge and real-world application in a critical care setting.

Results: A total of 98 ICU nursing staff individuals—69.4% female and 30.6% male—ppartook in this review. The greater part of respondents (73.5%) were between the ages of 20 and 30, and the larger part (68.4%) had a four-year college education in nursing. Experience went from one to five years, with 61.2% of medical attendants having worked in the field. Surprisingly, 76.5% of members had gotten preparing in the earlier year, and 87.8% of members detailed having gotten conventional preparation in radiation security. Moreover, a sizable, larger part (85.7%) of respondents showed a serious level of mindfulness with respect to radiation wellbeing methodology by demonstrating that they knew an extraordinary arrangement about the ALARA guideline.

Conclusions: The research findings indicate that although ICU nurses have a fair comprehension of radiation safety, there are notable deficiencies in their knowledge and cultural disparities that require attention. To advance radiation safety practices, more comprehensive safety protocols, better training, and frequent evaluations are required. Furthermore, knowledge and behavior are greatly influenced by training, education, and clinical experience, which emphasizes the necessity of environmental enhancements and all-encompassing education in order to effectively promote radiation safety.

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CHAPTER-1
INTRODUCTION

1.1 Overview

ICUs pose unique challenges for radiation safety due to the frequent use of portable X-ray machines. The confined space, the critical condition of patients, and the presence of other medical equipment complicate the application of standard radiation protection measures. Role of ICU Nurses: ICU nurses are responsible for patient positioning, assisting radiographers, and sometimes operating portable X-ray equipment. Their understanding of radiation safety principles is crucial to minimize exposure risks. Previous Research: Studies in various healthcare settings have highlighted the need for improved radiation safety training among non-radiology staff, including ICU nurses. In many cases, knowledge gaps have been linked to suboptimal safety practices.

Radiological examinations for patients who are hospitalized at intensive care units are usually performed using portable radiography devices However they may require knowledge and safety precautions of nurses. Lack of information about radiation safety may cause nurses to fear radiation exposure, harming patient care. Before and after radiation, oncology nurses are essential in monitoring patient care and coordinating therapy. They must be knowledgeable about radiation protection and mindful of their attitudes towards radiation to do their duties efficiently. The extent to which nurses use, and are exposed to, ionizing radiation in their daily work varies internationally and depends on their specific work assignment. Hence, several studies have investigated nurses' levels of exposure to ionizing radiation.Today, its use is covered by guidelines issued by international radiation safety oganizations . In addition, in European countries, its use in healthcare settings is governed by regulations set by the European Council. Individual countries may also have their own national regulations and guidelines, such as the Radiation Act (859/2018) that governs use of ionizing radiation in Finland . In recent years, nurses in several countries have been given the right to make referrals for medical imaging examinations that utilize radiation

Radiation protection

- International Atomic Energy Agency (IAEA) as "The protection of people from harmful effects of exposure to ionizing radiation, and the means for achieving this.
- The IAEA also states "The accepted understanding of the term radiation protection is restricted to protection of people

1.2 Harmful Effects

- Stochastic effects

- Non deterministic effects
- Somatic effects
- Reproductive effects

1.3.Protection Group

- Occupational
- Medical
- Public radiation protection
- Population as whole

1.4.1.A. 2 Types

- X-ray
- CT Scan

In the world today, two sets of units exist. They are the Special units (Curie, Roentgen, Rad and Rem) and SI or International Units (Becquerel, Gray and Sievert). In the United States, the Special units must be used as required by Federal law.

1.5. Units Conversion Equilence

1 curie 3.7 x 1010	1becquerel
Disintegrations per second	1disintegration per second
1 millicurie (mCi)	37 megabecquerels (MBq)
1 rad	0.01 gray (Gy)
1 rem	0.01 sievert (Sv)
1 roentgen (R)	0.000258 coulomb/kilogram (C/kg)
1 megabecquerel (MBq)	0.027 millicuries (mCi)
1 gray (Gy)	100 rad
1 sievert (Sv)	100 rem
1 coulomb/kilogram (C/kg	3,880 roentgens

Current literature shows a lack of recent, relevant studies conducted in large tertiary cen tres regarding radiation safety awareness of nursing staff. A study conducted in a Kuwaiti Radiology department shows that the

vast majority of nurses did not understand the risks of working with ionising radiation [3], Furthermore, a study that focused on the prepared- ness of hospital nurses in dealing with radiological emergencies found that further training is required. The willingness to respond to radiological emergency was low and the perception of personal safety was the deterrent [4]

Another issue relates to the overlapping involvement of distinct professional groups (nurses, doctors radiographers with varying degree of expertise and specialization). This complicates implementation of the change, since evaluating the level of radiation knowledge among different occupational groups is complex. Thus, international studies have identified a need for further research on the current level of radiation knowledge among nurses working in relevant environments [5-6,8,10-11]

Previous studies have noted a general lack of radiation education among nurses working with radiation [5,12], and various countries' radiation safety policies impose few (if any) requirements for nurses to have such education [13]. In Finland, only a few universities of applied sciences provide modules related to radiation in nurse education programs.

The previous statement show vital role in the healthcare sector since they accompany patients most of the time. during the inward radiation, they can be exposed to radiation while working behind protective barriers 'ere are two probable sources of radiation exposure from the occupational viewpoint. true radiation source is the X-ray tube, but workers may be inadvertently exposed to the primary beam in rare situations. 'e second source of radiation exposure is the patient. 'e interaction between the primary X-ray beam and the area of the patient's body getting imaged creates scattered radiation originating from the patient in all directions. However, in most situations, occupational exposure's key determinant is nurses' proximity to the patient as exposures are taking place. According to the WHO, IAEA, and ICRP, radiation protection should be standardized to the highest possible safety level. lack of ionizing radiation awareness among nurses can cause them to be unable to effectively protect themselves and their patients[11,12,13,14,16].

This study was conducted to evaluate the radiographers' awareness of radiation protection principles in the radiology centers of the hospitals of Bandar Abbas, Iran. In addition to the natural resources, they expose to the industrial, medical, and other sources radiations. Among all the industrial sources, the diagnostic X-ray devices deliver the highest amount of radiation dose to the medical staff. These devices have the first rank among the artificial sources of radiation, which endanger the human life due to their dangerous radiations [2].

In a study, Paolicchi et al. showed that the knowledge level of young radiographers (with less than 3 years of experience) about the radiation protection was higher than the more experienced ones. In another study, Alhasan et al. concluded that there was no significant difference in the awareness level of the radiographers working at various hospitals except for the awareness of radiation dose. The first part was related to the demographic information of the radiographers (i.e. age, gender, work experience, shift work, workplace, and passing retraining courses). The second part of this questionnaire entailed questions related to the radiographers' awareness of three fields including radiology physics radiation protection (such as As Low As Reasonably Achievable Principle, the most effective way to reduce expo-

sure, wearing lead apron during working hours, etc.), and hazards of radiation (such as fetal sensitivity to radiation, side effects of radiation, sensitivity to radiation in different age periods, etc.). The validity of this instrument was confirmed by two medical physicists. In addition, the reliability of this tool was evaluated as internal consistency using Cronbach's alpha coefficient, which rendered an acceptable internal reliability ($\alpha = 0.742$). The data analysis was performed using the SPSS version 11.5. 3. Results Furthermore, they showed that training courses and experience do not correlate significantly with the total score or the score of specific sections such as general radiation protection, radiation dose estimation, and radiation induced cancer risk [5,6].

The intensive care unit (ICU) is a critical care environment utilizing advanced monitoring and therapeutic technologies to care for patients with severe and life-threatening illnesses. The complex and unstable condition of ICU patients frequently necessitates the use of diagnostic imaging, particularly mobile X-rays and computed tomography (CT) scans, to facilitate rapid clinical decision-making (Khalid Alshamrani, 2022; Shubayr et al., 2021

CHAPTER-2

AIM AND OBJECTIVE

2.1. Aim of the study

ICU Nurses Knowledge of Radiation Safety and Their Behaviours Towards Portable Radiological Examinations

2.2. Objectives –

1. To Assess Occupational nursing characteristics.

2. To Assess the Cognitive knowledge of radiation protection,

3. To identify the Attitudes regarding institutional radiation policies, precautions, and exposure.

4.To evaluate nurses' awareness in the operating room, ICU, CCU, and PICU about radiation protection principles of portable radiography at hospital.

CHAPTER-3

REVIEW OF LITERATURE

3.1 Mansoor Dianati et.al. (2014), the title of the study "**intensive care nurses' knowledge of radiation safety and their behavior towards portable radiological examinations".** Using census sampling, 44 intensive care nurses were enlisted for this cross-sectional descriptive study between April and May 2014. Kashan. Iran's Shahid Beheshti Hospital's intensive care units served as the study's location. The knowledge and behaviors of nurses about radiation protection were assessed using an eleven-item questionnaire and a five-item checklist, respectively. An expert panel of ten radiology and nursing faculty members confirmed the validity of the survey and inventory. Additionally, ionizing radiation exposure levels were measured during portable radiological examinations using a Geiger-Müller counter. Leaving the intensive care unit while portable radiological exams were being conducted was the most common radiation protection behavior among nurses. While radiological examinations. Because nurses' awareness of radiation protection was lacking. Portable radiological examinations did not expose healthcare providers to high doses of ionizing radiation. Nurses' radiation protection knowledge was limited and hence, they require in-service education programs

3.2 Mohammed ali alzubaidi et.al. (2017) the title of the study "**assessment of knowledge and attitude of nurses towards ionizing radiation during radiography in jeddah city**". The level of knowledge was significantly a need for other educational safety programs to increase the knowledge of the rest of nurses. The lack to assess the knowledge and attitude of nurses towards ionizing radiation during radiography in jeddah city. A knowledge gap in the area of ICU nurses knowledge and behavior concerning protection against portable radiation. Decreasing the exposure time and dose a well as increasing the distance from the source could protect patients and occupational health workers. The nurses usually present at the radiology wards and theatre as they offer the health care for patients during and after radiological investigations. Need for other educational safety programs to increase the knowledge of the rest of nurses. To impact on the knowledge of radiation safety and practice in the work place.

3.3 Mohsen shafie et. al .(2020) the title of the study to **assess the knowledge and practice of medical professionals on radiation protection in interventional radiology.** Ionizing radiation has been extensively used in medical procedures throughout the world. Such interventional radiological procedures could result in occupational exposure that needs urgent control. Numerous interventional medical imaging procedures can potentially expose the workers to the low energy radiation which may

cause biological stochastic effects on the MPs.Stochastic effects refer to the mutations which can potentially lead to cancers or genetic disorders. The primary basis for estimating the cancer risks due to the ionizing radiation exposures are the epidemiological studies on the Japanese atomic bomb survivors who were primarily exposed to high dose rates. The potential benefits of MPs, as active players in radiation protection, need to be emphasized in universities and hospitals, where the curriculum contents in radiation sciences are insufficient. Additional training is also recommended in medical schools or hospitals

3.4 Khandaker et. al. (2023). The title of study **"Radiation in the intensive care units: A review of staff knowledge, practices, and radiation exposure".** Their commitment to promoting a cul ture of safety, in line with the ALARA (As Low As Reasonably Achiev able) principle, is essential for safeguarding the health of both patients and healthcare workers. This review provides a comprehensive evaluation of the current literature concerning radiation knowledge and practices amongst ICU staff as well as patients and staff radiation doses. The goal is to identify strengths and weaknesses in the current state of radiation knowledge and practice in the ICU and provide evidence-based recommendations to enhance radiation safety for patients and healthcare workers in this vital hospital environment.

3.5 Dianati et. al. (2014). the title of study **"Radiation in the intensive care units: A review of staff knowledge, practices, and radiation exposure".** A study by Rassin et al. eval uated the radiation knowledge and attitude of 68 physicians and 76 nurses working in high-exposure clinical settings. They found that more than 70% of physicians and nurses had limited knowledge regarding the hazards of radiation, the amount of environmental radiation of each radiological examination, and radiation protection strategies The intensive care unit (ICU) is a critical care environment utilizing advanced monitoring and therapeutic technologies to care for patients with severe and life-threatening illnesses. The complex and unstable condition of ICU patients frequently necessitates the use of diagnostic imaging, particularly mobile X-rays and computed tomography (CT) scans, to facilitate rapid clinical decision-making intensive care unit, ICU, critical care, radiation, X-ray, CT, radiography, radiation protection, knowledge, awareness, practice, compliance, and training. To enhance the rigor and transparency of our literature review, the Preferred Reporting Items for Systematic Reviews and Meta- Analyses (PRISMA) guidelines were employed in the study selection process. This systematic approach enabled us to screen and exclude studies that did not meet our predefined criteria, ensuring a focused and relevant analysis of the research on radiation kno-wledge and practices among ICU staff. The ICU frequently utilizes mobile radiographic imaging due to the critical condition of patients. Mobile X-ray machines are wheeled units that can be easily transported and positioned at the patient's bedside.

3.6 Aisyah Mohd Rahimi et.al. (2021) the title of study **"Malaysian Nurses' Knowledge of Radiation Protection: A Cross-Sectional Study".** the study shows that Malaysian nurses are well educated about radiation protection and radiation usage but lack radiation physics knowledge. 'is has serious implications for both patients and nurses. Training and learning by providing skills for all nurses involved in the ionizing radiation is a key for optimizing quality and education. Therefore, healthcare organizations play an important role in ensuring that all nurses in Malaysia are well educated about radiation knowledge by enhancing education requirements for all nurses who act around or are exposed to radiation. In conclusion, the findings demonstrate the value of radiation knowledge and radiation understanding and, most significantly, the function and role of education to ensure the safe use of medical radiation Malaysian Nurses' Knowledge of Radiation Protection: A Cross-Sectional Study radiological examination using X-rays remains the most widely used ionizing radiation in the medical field. It is liable for the most significant human-made radiation exposure to the worldwide population.

3.7 Sharafi, H. et.al. (2018). "Knowledge of medical staff about the principles of radiation protection in Bandar Abbas city". Some diseases such as cataracts, leukemia, and skin lesions (e.g., erythema and hair loss) have been reported in workers who have exposed to high levels of radiation. Also, in some studies, cancer has been reported due to long exposure to radiation In this study, our target group was all employees who used radiation as part of their work (radiology technician, technologist, nurses, etc.) in different sections. Knowledge of the principles of radiation protection in radiological examinations in other parts in addition to radiology, it is a critical issue because the probability of radiation complications during portable radiographs is higher than standard radiography. In this study, we examined the knowledge of medical staff in different sections of the hospital regarding the principles of radiation protection. In this study, the knowledge of all personnel of different sections of the hospital about radiation was studied, while in previous studies only the radiology department staff was investigated. Generally based on the findings of the current study, the knowledge of the medical staff was evaluated from. This descriptive cross-sectional study was performed on health workers who exposed to radiation in Sha hid Mohammadi Hospital, Bandar Abbas, Iran during 2018.

3.8 Siddiqui, S. S., Jha et. al. (2014). Radiation exposure among medical professionals working in the Intensive. Radiological investigations and therapeutics have become an integral part of the management of critically ill patients in the Intensive Care Unit (ICU). Patients admitted to the ICU routinely undergo bedside imaging procedures such as chest radiographs for diagnosing heart, lung and other pathology, and for confirmation of the position of devices like endotracheal tubes, nasogastric tubes, central venous catheters and intercostal drains. A review article has suggested that among ICU

patients, up to 65% of daily chest radiographs and 70-75% of chest computerized tomography (CT) scans reveal significant or unsuspected abnormalities that may lead to a change in the patient's management. However, the available literature on the extent of radiation exposure to ICU personnel is scarce and relates mainly to the level of scattered radiation within the ICU. In our ICU in a tertiary care cancer referral center, resident doctors working on 12 h shifts in the ICU are also responsible for the transport and management of ICU patients when they undergo diagnostic and therapeutic procedures in the Radiology Department. We, therefore, carried out this study to determine the total radiation exposure to ICU resident doctors involved in the course of their duties. In most situations, the ICU team is responsible for the transport and management of the patient in the radiology department for these procedures. This can significantly increase the cumulative radiation exposure to ICU personnel. There is, therefore, potential radiation exposure to healthcare workers, particularly for those working for long periods of time in the ICU. Epidemiological data indicates that the exposure to even low-dose radiation may be a cause for concern because such exposure can result in leukemia, thyroid malignancies and other cancers

3.9 N. Shubayr et. al. (2021). "Occupational radiation exposure among diagnostic radiology workers in the Saudi ministry of health hospitals and medical centers: A five-year national retrospective study" The International Commission on Radiological Protection (ICRP) expressed occupational radiation dose in terms of effective dose and equivalent dose. The effective dose is the dose to the whole body, while the equivalent dose is the dose to the skin, extremities, and lens of the eyes. The annual effective dose A retrospective analysis was performed on the effective radiation doses for diagnostic radiology workers (DRWs) in Saudi Arabia for a period of five years (2015–2019). The workers were employed in 412 Saudi Ministry of Health (MOH) hospitals and centers in all of the Saudi administrative regions. These workers were employed in general x-ray, computed tomography, fluoroscopy, and mammography departments. The Radiation Protection Program (RPP) operates as a national register and regulator of occupational radiation doses for all medical centers' work under the umbrella of the MOH. Therefore, this study focuses on the effective dose for the diagnostic radiology personnel in general. During the five-year study period, there was no incidence of an occupational dose exceeding the annual regulatory limit of 20mSv or the investigation level I adopted by the RPP. This indicates a proper implementation of the radiation protection protocols in compliance with ICRP recommendations. However, occupational radiation exposure should continuously remain as low as is reasonably achievable (ALARA). A2016 study in Saudi Arabia found that the majority of the national hospitals were equipped with lead apron sand thyroid shields. However, around50%of these hospitals have protective

3.10 S. O. Paulinus. et. al. (2016). "Evaluation of Nurses' Knowledge of Radiation Protection Practice: A Case Study of Two Hospitals in Calabar, Nigeria". Nurses and other health professionals (non-radiation workers) who work as a team usually assist and accompany patients (especially the critically ill) to the Departments of Radiology or sometimes Radiotherapy for examination (medical exposure) and for further evaluation. While there is an increasing patient awareness that unnecessary radiation exposure from x-rays can cause health problems, most patients have no knowledge that the dangers of ionizing radiation, due to medical imaging, can reach atomic bomb levels. Nurses are highly trained and skilled professionals who care for the sick and infirm, and also help to educate patients on the issue of healthy living and wellness as wells as chronic disease processes and treatment. Nurses are caregivers often involved in assisting and accompanying patients to the Radiology Department for medical exposure to radiation for both diagnostic and therapeutic purposes. Exposure to ionizing radiation without adequate protection is implicated in causing harm to man. The study was designed to evaluate Nurses' knowledge of radiation protection practice as direct care givers in the University. The increasing use of radiation in form of waves or particles emitted from a source travelling through space which can transmit all or part of its energy on contact with matter

3.11 Aishatu Babagana Ajikolo. et. al. (2016). "Assessment of Knowledge and Attitude of Nurses towards Ionizing Radiation during Theatre/Ward Radiography". The researchers observed that during radiographic examinations on the ward, some nurses are extremely afraid to stay within the vicinity during radiation exposures, or just move some distance away but on sitting the radiographer with the mobile X-ray machine on the ward, they leave you with the patient and do not even want to come closer and help in lifting the patient even while no exposure is going on, and despite the reassurance and radiation protection measures employed by the radiographer. These reactions of some nurses towards ionizing radiation and the need to understand why they behave differently prompted the researchers' interest to find out the level of knowledge on ionizing radiation and their attitude towards radiation protection. This study aimed to assess the knowledge and attitude of nurses towards radiation protection during ward and theatre radiography. Reduction of exposure time, increasing distance from source, and shielding of patients and occupational workers have proven to be of great importance in protecting patients, personnel, and members of the public from the potential risks of radiation. Nurses posted to the radiology department and those in the wards and theatre where radiography procedures are done, offers professional care to patients before, during and after radiologic procedures. They help to book reassure and prepare patients for special radiologic procedures and as well provide after care to patients after the procedures. Nurses also help to support the patient during the procedure and also prepare the equipment and instruments needed during the examination. The risk of radiation awareness among the people by the media is aggressive and

exaggerated which creates several misconception, confusion and erroneous beliefs that exist with regard to in-hospital radiation hazards. Studies have documented that most people overestimate the risk of industrial radiation and underestimate the risk of medial radiation application.

3.12 Priyantha Edison.et. al. (2017). "Reducing radiation hazard opportunities in neonatal unit: quality improvement in radiation safety practices". Extraneous adult fingers were frequently noted on the images. We observed that the NICU staff needs to be much closer than 1 m during radiation exposure to hold the neonate, often without lead protective gear and their hands may inadvertently fall within the primary beam. Previously published studies have shown4 that 15%–40% of NICU films had at least one adult finger visible in the images. X-rays with liberal inclusion of anatomy adja cent to the region of interest. Although the very small size of patients in the NICU may be cited as a limitation for proper collimation, studies show that at least 50% reduction in unnecessary radiation exposure is feasible regard less of gestational age, birth weight or patient size with proper collimation technique alone. Bedside neonatal radiological examinations can be challenging assignments for the radiographers with varying levels of expertise, as the NICU environment makes it less than ideal for standard examination protocols to be adhered to. Neonates cannot cooperate, and very often monitoring devices, access lines or tubes may interfere with the image quality and positioning accuracy.

3.13 Shing-Yau Tam. et. al. (2023). "Scatter Radiation Distribution to Radiographers, Nearby Patients and Caretakers during Portable and Pediatric Radiography Examinations". Other than interventional radiology, scatter radiation may affect other parties in various settings. Scatter radiation from portable X-rays in wards could affect nearby patients and healthcare professionals. While scatter radiation from pediatric X-rays may affect caregivers who help with the positioning of infants. To reduce the scatter radiation exposure to radiological staff and other parties, increasing distance and shielding are the common strategies. It has been long assumed that the scatter radiation will decrease with increasing distance by inverse square law. However, the irregularity of scatter radiation may reduce the effects of radiation dose reduction by increasing distance as pointed out by a recent study. Wes elected 4 commonly used portable X-ray projections, including anteroposterior (AP) abdomen (Figure 1a), AP chest (Figure 1b), AP, and lateral right knee for evaluation. The exposure settings including field size, tube voltage (kVp), tube current-time product (mAs), and source-to-image-receptor distance (SID) The bed height was 75 cm. Suitable collimations were applied according to the local practice. For the measurement points, a three-dimensional coordinate plot has been set in the portable X-ray room

3.14 Mohammed K. Saeed. et. al. (2018). "Radiation awareness among physicians about the hazards of radiological examinations on the health of workers and their patients in Saudi Ara-

bia". In addition, this study will compare the different background knowledge for physicians from different countries, including Saudis working in Saudi Arabia. This comparison will also include a comparative evaluation of knowledge of the physicians who work in Saudi Arabia, and physicians in different countries. This study will be useful for the Saudi Council for Health Specialties (SCFHS) in Saudi Arabia and, for the other local educational institutions to review and increase their education activities to protect patients from unnecessary harmful radiations. There are no recommended limits regarding the number of radiological examinations for patients, however, the physicians should be able to compare the radiation doses that are associated with the various medical imaging modalities. The physicians' information about personal protection devices was proper, especially for the location in the lead apron, but they show lack of knowledge about the annual recommended dose to the whole body of a radiation worker. The risks associated with the growing diagnostic applications of X-ray in medicine will potentially increase the radiation dose received by the patients. It further confirms the report issued by the Health Protection Agency (HPA) Centre for Radiation. Furthermore, the radiation dose measured in routine X-ray examinations is scanty, and recently only a few surveys to evaluate the patients' doses from different diagnostic radiologic examinations.

3.15 Kadir Gelis. et. al. (2017). "Investigation of awareness levels about the radiation safety of personnel working in the imaging units of the hospitals in Agri, Turkey". Radiation is the energy emission or transmission in the form of waves or particles which can penetrate substance and human being. Radiation is divided into two groups as Ionizing Radiation and Non-Ionizing Radiation according to its effects on the substance. Ionizing radiations cause ionization by breaking apart an electron from an atom or molecule. Radiation protection rules can be grouped under three headings: distance, exposure duration and shielding. As you approach the source of radiation, the dose rate(intensity)of the radiation increases inversely proportional to the square of the distance. According to this result, it can be argued that occupational type variable is not a decisive factor on the radiation safety knowledge levels of health care workers. The state of differentiation of radiation safety knowledge levels of health care workers were examined according to some de myographic characteristics and their results are given below. Begin with general studies on radiation safety awareness among healthcare workers worldwide to set a benchmark. Narrow down to studies conducted in Turkey, particularly in regions similar to Ağrı, to contextualize the findings. Look for specific studies conducted in Ağrı or nearby regions, considering cultural and institutional differences. Assess how well healthcare workers understand radiation risks, safety protocols, and the use of protective equipment.

3.16 Sewon Park. et. al. (2022). "Radiation safety for pain physicians: principles and recommendations". Use combinations like "radiation safety," "pain physicians," "interventional pain

management," "fluoroscopy safety," "radiation exposure," and "radiation protection guidelines." Start with literature that explains the basic principles of radiation safety, including ALARA (As Low As Reasonably Achievable), time, distance, and shielding. Focus on articles that discuss the specific radiation risks in pain management procedures, such as those involving fluoroscopy, and the corresponding safety measures. Look for guidelines from authoritative bodies like the International Commission on Radiological Protection (ICRP), the American Society of Interventional Pain Physicians (ASIPP), and similar organizations. Review studies on the use of radiation-reducing technology in pain management, such as low-dose fluoroscopy settings, personal protective equipment (PPE), and radiation shields. Discuss the specific risks associated with the frequent use of fluoroscopy in interventional pain procedures. Summarise the strategies recommended in the literature to minimize radiation exposure to both physicians and patients. Highlight best practices for using protective gear, including lead aprons, thyroid shields, lead glasses, and the importance of proper positioning during procedures. Highlight best practices for using protective gear, including lead aprons, thyroid shields, lead glasses, and the importance of proper positioning during procedures. Regulatory Standards: Examine the legal and institutional requirements for radiation safety in pain management settings.

3.17 Suzuki-Utsunomiya.et. al. (2012). "32nd International Symposium on Intensive Care and Emergency Medicine". Reviewing the literature related to the 32nd International Symposium on Intensive Care and Emergency Medicine (ISICEM) involves identifying and summarising key presentations, studies, and trends discussed during the symposium. This process can help you understand the state-of-the-art practices, emerging research, and future directions in intensive care and emergency medicine. The ISICEM is one of the largest annual gatherings for professionals in the field of intensive care and emergency medicine. It typically features a wide range of topics, from the latest research findings to clinical practices and innovations. Identify and summarise the main themes and findings from the plenary sessions. These often highlight the most significant developments in the field. Review the content of workshops or special sessions that focus on emerging technologies, new therapies, and innovative approaches to patient care. Summarise key clinical trials or studies presented at the symposium, especially those that have influenced current practices in intensive care and emergency medicine. Consider the viewpoints of leading experts presented during the symposium, especially on controversial or rapidly evolving topics.

3.18 Ruby Niaz. et. al. (2021). "Assessment of Level of Awareness Towards Radiation Protection Among the Staff Working at Angiography Suite at Public Hospitals". Look for studies that assess the general level of awareness of radiation risks and protective measures among healthcare staff in angiography suites. Review literature on the availability and effectiveness of radiation protec-

tion training programs for staff. Examine studies that investigate how well staff comply with radiation safety protocols, including the use of protective equipment like lead aprons, thyroid shields, and dosimeters. ALARA (As Low As Reasonably Achievable) is a key principle in radiation safety. Assess how well staff understand and implement these principles in their daily practice. Review studies that measure the actual radiation exposure levels of staff working in angiography suites and how these relate to their awareness and protective practices. Summarize findings on the current awareness and knowledge levels regarding radiation protection among staff. Explore the correlation between awareness levels and the implementation of safety practices in the angiography suite. Consider any differences in awareness levels based on job role, experience, or education. For example, compare the awareness of radiologists versus nurses or technologists. Discuss how institutional policies at public hospitals impact the level of awareness and compliance with radiation safety protocols.

3.19 Fiachra Moloney. et. al. (2016). "Cumulative radiation exposure from diagnostic imaging in intensive care unit patients". Studies indicate that while individual imaging procedures may have low radiation doses, the cumulative effect can be significant, particularly in long-term ICU patients. Some studies advocate for routine dose tracking and suggest that cumulative doses in some patients can approach or exceed levels associated with increased cancer risk. Implementing protocols that limit unnecessary imaging. Educating ICU staff about the risks of cumulative radiation exposure. Considering the cumulative dose in decision-making processes for further imaging. This overview summarizes the key points typically found in a literature review on cumulative radiation exposure in ICU patients. Specific studies might provide detailed statistics, trends over time, and recommendations based on current practices in ICU settings. Generally minimal, but immediate concerns include the potential for acute radiation effects in highly exposed tissues. Increased cumulative exposure is associated with a heightened risk of cancer, particularly in younger patients or those with prolonged ICU stays. ICU patients often undergo repeated imaging studies due to their critical condition, leading to cumulative exposure. Studies have quantified the number of imaging procedures an ICU patient might receive during their stay, which can range from several to dozens depending on their length of stay and condition.

3.20 James H McEvoy.et. al. (2019). "Cumulative radiation in critically ill patients: a retrospective audit of ionizing radiation exposure in an intensive care unit". Critically ill patients in ICUs often require frequent imaging studies, including X-rays, CT scans, and sometimes fluoroscopy. These modalities, while essential for diagnosis and management, expose patients to ionizing radiation, which can have cumulative effects. The cumulative dose of radiation can be significant due to the repetitive nature of these diagnostic procedures, leading to potential long-term risks, including an. The radiation dose from a single chest X-ray is low, but CT scans, especially of

the abdomen and pelvis, can contribute significantly to the total radiation dose. ICU patients often undergo multiple CT scans during their stay, leading to higher cumulative doses. The risk of radiation-induced cancer is generally low but becomes more concerning with higher cumulative doses. The linear no-threshold model suggests that even low doses of radiation could have a proportional increase in cancer risk. Literature suggests careful justification for each imaging study, especially CT scans. Strategies to reduce radiation exposure include optimising imaging protocols, using alternative imaging modalities (e.g., ultrasound or MRI), and cumulative dose tracking.

3.21 Mayeen Uddin Khandake. et. al. (2023). "Investigation of the Radiographer's adherence and compliance with radiation protection and infection control practices during COVID-19 mobile radiography". The COVID-19 pandemic posed unprecedented challenges to healthcare systems worldwide, requiring rapid adaptation of existing practices to ensure both patient and healthcare worker safety. Radiographers, particularly those involved in mobile radiography, were on the frontlines, tasked with the critical role of imaging patients suspected or confirmed to have COVID-19. This review examines existing literature on radiographers' adherence and compliance with radiation protection and infection control practices during the pandemic, with a focus on mobile radiography. reported that the rapid turnover of patients and the high volume of imaging studies sometimes compromised the thoroughness of decontamination procedures between patients. Additionally, the psychological stress of working in such high-risk conditions may have contributed to lapses in infection control practices (Adams & Walls, 2020). However, the literature also suggests that compliance varied across different settings and was influenced by factors such as resource availability, individual risk perception, and institutional culture (Wynia & Gostin, 2020). To improve adherence and compliance with safety practices in future pandemics or similar crises, the literature suggests the following: Ongoing training and simulation exercises focusing on both radiation protection and infection control in crisis scenarios can help maintain high compliance levels (Mossa-Basha et al., 2020).

3.22 Khalid Alshamrani. et. al. (2022). "Radiation Safety While Providing Bedside Care During Portable Radiography Procedures: Knowledge and Awareness of Respiratory Therapists and ICU Nurses". Radiation safety is a critical component of patient care in healthcare settings, particularly during portable radiography procedures performed at the bedside. These procedures often occur in Intensive Care Units (ICUs), where patients are too ill to be transported to the radiology department. The healthcare personnel involved, including respiratory therapists and ICU nurses, must be knowledgeable and aware of radiation safety protocols to protect both themselves and their patients from unnecessary exposure. This literature review examines the current state of knowledge and awareness of radiation safety among respiratory therapists and ICU nurses. Portable

radiography is commonly used in critical care settings to obtain diagnostic images without the need to move patients. While this is advantageous for patient care, it also presents increased risks of radiation exposure to both the patient and healthcare staff. Radiation safety practices are governed by the principles of time, distance, and shielding—minimizing the time of exposure, maximizing the distance from the radiation source, and using appropriate shielding to protect from scatter radiation (Seeram & Davidson, 2018). Healthcare workers in ICUs, including respiratory therapists and nurses, often remain in the vicinity during imaging procedures due to their critical role in patient care. However, their knowledge and adherence to radiation safety practices are crucial to reducing unnecessary exposure (Bushong, 2017). Literature suggests that while radiographers are well-trained in radiation protection, other healthcare workers may not have the same level of training or awareness, which could lead to increased exposure risks (Smith & Finney, 2019).

3.23 Ahmed Ghoniem. et. al. (2020). "A tentative guide for thoracic surgeons during COVID-19 pandemic" The COVID-19 pandemic posed significant challenges to thoracic surgery, given the virus's respiratory nature and the critical role of the lungs and airway in thoracic procedures. The pandemic required thoracic surgeons to modify their practices to protect both patients and healthcare workers, manage scarce resources, and continue providing essential care. This review synthesizes the literature to offer a tentative guide for thoracic surgeons during the COVID-19 pandemic. Emergent and urgent thoracic surgeries, such as those for trauma or cancer, continued with enhanced precautions. The literature highlights the need to weigh the risks of surgery against potential delays, considering factors such as the progression of underlying conditions and the patient's COVID-19 status (Sarkaria et al., 2020). The importance of rigorous preoperative screening and testing for COVID-19 is emphasized across the literature. Guidelines recommend that all patients undergoing thoracic surgery be tested for SARS-CoV-2 before surgery, ideally using PCR testing (Thoracic Surgery Outcomes Research Network, 2020). In cases where rapid testing is unavailable, the patient's surgery should be postponed if possible, or treated as if COVID-19 positive, with full precautions in place. Patients should be stratified based on their surgical urgency and COVID-19 status. Elective surgeries should be deferred for patients testing positive for COVID-19 until they recover and test negative. For urgent cases, particularly in cancer patients, a multidisciplinary approach is advised to assess the risks of delay versus the risks associated with surgery during active or recent COVID-19 infection (Zaheer et al., 2021).

3.24 Ben Grinsted.et. al. (2020). "Technique, radiation safety and image quality for chest X-ray imaging through glass and in mobile settings during the COVID-19 pandemic". This technique is only used for clinically deteriorating suspected/confirmed COVID-19 patients who are able to be sat erect, necessitating nurse assistance in the room. The radiographer outside of the room

positions the X-ray unit with the X-ray tube head close to the glass and col limates the X-ray beam appropriately, ensuring the X-ray beam is fully intercepted by the detector. The X-ray beam passes through the glass door/window and exposes the digital detector. This technique is not used through lead glass, which would attenuate the X-ray beam to a level that is no longer diagnostically useful. The standard technique of mobile chest imaging is also being required more widely in ED so that suspected COVID-19 patients are not transported to the fixed X-ray rooms, limiting risks to staff and reducing disinfection cleans. Institutional ethical board approval was obtained for this study, as well as informed patient consent for medical images used in this publication. The isolation and social distancing measures implemented by federal and state governments have so far managed to "flatten the curve" and there has not yet been a surge of patients on healthcare networks as was predicted based on overseas experience. We developed a method within our institution, which requires a radiographer and a nurse wearing personal pro tective equipment (PPE) to position a double bagged digital detector and the bed inside the patient cubicle and a second radiographer to operate the X-ray unit outside the cubicle.

3.25 Lamia Hjiyej Andaloussi.et. al. (2021). "Medical staff who use ionizing radiation at Ibn Rochd University Hospital Center of Casablanca, Morocco: evaluation of radiation protection knowledge". Radiation protection is a critical aspect of healthcare, particularly for medical staff who routinely use ionizing radiation in diagnostic and therapeutic procedures. The potential risks associated with exposure to ionizing radiation necessitate comprehensive knowledge and adherence to safety protocols to protect both patients and healthcare workers. This literature review evaluates the current state of radiation protection knowledge among medical staff at the Ibn Rochd University Hospital Center in Casablanca, Morocco, and compares it with global standards and practices. Ionizing radiation is widely used in medical settings for diagnostic imaging (e.g., X-rays, CT scans) and therapeutic procedures (e.g., radiotherapy). While these technologies are invaluable for patient care, they also pose significant risks, including radiation-induced injuries and long-term effects such as cancer. Consequently, radiation protection measures, guided by the principles of justification, optimization, and dose limitation, are essential in minimizing these risks (Seeram & Davidson, 2018). Healthcare workers, including radiologists, radiographers, nurses, and physicians, must be well-informed about radiation protection principles to ensure safe practices. The literature highlights that knowledge and adherence to radiation protection protocols vary widely among healthcare professionals, often depending on their level of training and the institutional emphasis on safety (Vano et al., 2019). In developing countries, where resources for training and equipment may be limited, the gaps in knowledge can be even more pronounced. Research in sub-Saharan Africa, for example, revealed that many healthcare workers were unaware of basic radiation safety principles, such as the importance of distance and shielding (Mbele et al., 2020).

3.26 Talaat Salahdin Ahmed.et al. (2020). "Cumulative Radiation Exposure from Diagnostic Imaging in Zagazig University Pediatric Intensive Care and Chest Units". The use of diagnostic imaging in pediatric intensive care units (PICUs) and chest units has become an essential tool in managing critically ill children. However, the cumulative radiation exposure associated with frequent imaging raises concerns about the long-term risks, particularly in pediatric patients who are more susceptible to the harmful effects of ionizing radiation. This literature review examines the extent of cumulative radiation exposure in pediatric patients in PICUs and chest units at Zagazig University, Egypt, comparing it to global data and exploring strategies to mitigate risks. Pediatric patients are particularly vulnerable to radiation-induced harm due to their developing tissues and longer life expectancy, which provides a greater window for the manifestation of radiation-related health effects, such as cancer. Studies have shown that children are at a higher risk of developing malignancies from ionizing radiation compared to adults (Brenner & Hall, 2007). The linear no-threshold (LNT) model, widely accepted in radiology, suggests that even low doses of radiation may increase the risk of cancer over time (UNSCEAR, 2013). Diagnostic imaging in PICUs and chest units often involves modalities such as chest X-rays, CT scans, and fluoroscopy. While these tools are invaluable for patient care, they contribute to cumulative radiation exposure. CT scans, in particular, are associated with higher doses of radiation, with one scan potentially delivering up to 200 times the dose of a single chest X-ray. Limited studies have been conducted on cumulative radiation exposure in pediatric patients in Egypt, but the available data suggests that similar concerns exist. Studies from other regions in the Middle East, such as Saudi Arabia, have reported high cumulative doses in pediatric patients due to repeated imaging.

3.27 Mohmmadreza Aramesh.et al.(2017). "Evaluation of Radiation Dose Received by Premature Neonates Admitted to Neonatal Intensive Care Uni". Premature neonates admitted to Neonatal Intensive Care Units (NICUs) often require frequent diagnostic imaging to monitor their critical health conditions. However, the exposure to ionizing radiation from these procedures can pose significant risks, particularly given the heightened sensitivity of premature neonates to radiation. This literature review examines the radiation doses received by premature neonates in NICUs, evaluating the associated risks and discussing strategies to minimize exposure. Premature neonates are exceptionally vulnerable to the effects of ionizing radiation due to their small size, rapidly dividing cells, and prolonged life expectancy. The developing tissues of neonates are more susceptible to radiation damage, which can increase the risk of long-term effects such as cancer, particularly during a period of rapid growth and development (Hall & Giaccia, 2012). Additionally, premature neonates often require intensive monitoring, which can involve repeated imaging studies. The most commonly used imaging modalities in NICUs include chest X-rays, abdominal X-rays, and sometimes cranial

ultrasound or fluoroscopy. While these procedures are essential for diagnosing and managing various conditions such as respiratory distress syndrome, necrotizing enterocolitis, and intracranial hemorrhage, they contribute to the cumulative radiation dose received by these vulnerable patients. Research indicates that premature neonates in NICUs can receive significant radiation doses due to the frequency of imaging studies. A study by Smans et al. (2008) reported that the cumulative effective dose received by neonates during their stay in NICUs could be substantial, depending on the number and type of imaging procedures performed. The study highlighted that the total radiation dose could range from a few micro-Sieverts (μSv) to several milli-Sieverts (mSv), with higher doses observed in neonates with prolonged NICU stays or those requiring complex medical interventions.

3.28 Abdulrahman H. Almalki. et al. (2021). "The compliance with radiation protection and knowledge about radiation exposure among the orthopedic operating room personnel in Saudi Arabia". The International Commission on Radiological Protection (ICRP) provides recommendations on occupational exposure limits and the use of protective measures. Saudi Arabia follows specific regulations and guidelines to ensure radiation safety in medical settings, which include wearing lead aprons, thyroid shields, and using protective screens. Studies often evaluate how well orthopedic personnel comply with established radiation safety protocols. Compliance can be influenced by factors such as the availability of protective equipment, training, and the perceived importance of radiation safety. Research has shown that while PPE like lead aprons and thyroid shields are commonly available, they are not always consistently used by all personnel. The level of knowledge about radiation risks and safety practices varies among orthopedic operating room personnel. Regular training and updates are crucial for maintaining high standards of radiation safety. Studies indicate that there can be significant gaps in understanding the long-term risks of radiation exposure, especially among non-specialist staff. Awareness campaigns and continuous education are necessary to address these gaps. Overall, while there are established guidelines and regulations regarding radiation protection in Saudi Arabia, the level of compliance and knowledge among orthopedic operating room personnel may vary. Efforts to improve education, training, and enforcement are crucial to enhance radiation safety in orthopedic practices.

3.29 Shing-Yau Tam. et al. (2023). "Scatter Radiation Distribution to Radiographers, Nearby Patients and Caretakers during Portable and Pediatric Radiography Examinations". Scatter radiation refers to secondary radiation that occurs when the primary X-ray beam interacts with matter, such as the patient's body. This scattered radiation poses potential health risks to those in close proximity, including radiographers, nearby patients, and caretakers. Understanding the distribution and intensity of scatter radiation is critical for establishing safety protocols and minimizing radiation exposure during radiographic procedures, especially in sensitive environments like pediatric wards.

Chronic exposure to low levels of scatter radiation can increase the risk of developing radiation-induced conditions, including cancer. This is particularly concerning for radiographers who are frequently exposed during their work, as well as for vulnerable populations like children. Guidelines from organizations such as the International Commission on Radiological Protection (ICRP) set exposure limits and recommend best practices to reduce unnecessary radiation exposure. Guidelines from organizations such as the International Commission on Radiological Protection (ICRP) set exposure limits and recommend best practices to reduce unnecessary radiation exposure. Portable radiography is often performed in less controlled environments, such as hospital wards, where it's difficult to use protective barriers. This increases the risk of scatter radiation exposure to individuals in the vicinity.

3.30 S. O. Paulinus. et al. (2016). "Assessment of Medical Attendants' Information on Radiation Security Practice: A Contextual Investigation of Two Clinics in Calabar, Nigeria." In clinical settings where radiographic methodology is frequent, it's fundamental for medical care laborers, including medical attendants, to be educated about radiation supportive of detection. This guarantees their security as well as the wellbeing of patients and other staff. The review means to evaluate the information level of medical caretakers in two emergency clinics in Calabar, Nigeria, in regards to radiation security rehearses. It looks to recognize holes in information and recommend upgrades in preparation and strategy. The critical standards of radiation security incorporate time, distance, and protecting. Legitimate comprehension and utilization of these standards can fundamentally lessen openness to unsafe radiation. Nurture frequently aid radiological strategies, oversee patients during imaging, and some of the time work compact X-beam machines. Their insight into radiation wellbeing is in this manner basic. Prior examinations in different districts have featured fluctuating degrees of information among medical services laborers in regards to radiation security, with a typical finding of lacking preparation and mindfulness, especially among non-radiology staff. The concentrate probably utilizes a cross-sectional plan, utilizing polls to survey the information on medical caretakers with respect to radiation insurance. Medical caretakers from two significant emergency clinics in Calabar were chosen. The example size, determination measures, and segment subtleties of the members (e.g., long stretches of involvement, division) are fundamental for grasping the setting of the discoveries. An organized poll was utilized, covering different parts of radiation insurance, including fundamental ideas, wellbeing measures, and individual defensive hardware (PPE) use.

CHAPTER-4
MATERIALS AND METHODS

4.1 Study Design: - Cross Sectional study

4.2 Sample Size: - 98

4.3 Place of Study: - Santosh Deemed to be university

4.4 Inclusion criteria: -

4.4.1 Age between – 20 to 30years

4.4.2 Nursing staff of ICU department

4.5 Exclusion criteria-

4.5.1 Nursing staff of another department

4.6 Methodology Study Design:

- The study likely uses a cross-sectional survey design, with data collected through questionnaires. The questionnaire would assess knowledge levels, while observations focus on actual behaviours during radiological procedures.

4.7 Tools:

4.7.1. Questionnaire:

- A structured questionnaire assessing knowledge of radiation safety, including topics likes the effects of radiation, protective measures, and regulatory guidelines.

4.8 Observation Checklist:

- An observation checklist may have been used to evaluate nurses' behaviours during portable X-ray procedures, such as the use of protective equipment, adherence to safety protocols, and communication with radiographers

4.9 DATA ANALYSIS:

- The data were inputted into an Excel spreadsheet
- For analysis, the data were put into an Excel spreadsheet. This procedure entailed methodically arranging the data to enable additional analysis. Excel was used to manage and manipulate data efficiently. As a result, this stage prepared the way for further analytical processes.

4.10 ETHICAL APPROVAL

- Ethical approval was obtained from the Ethical Committee of Santosh Deemed to be University, Ghaziabad.

CHAPTER.5

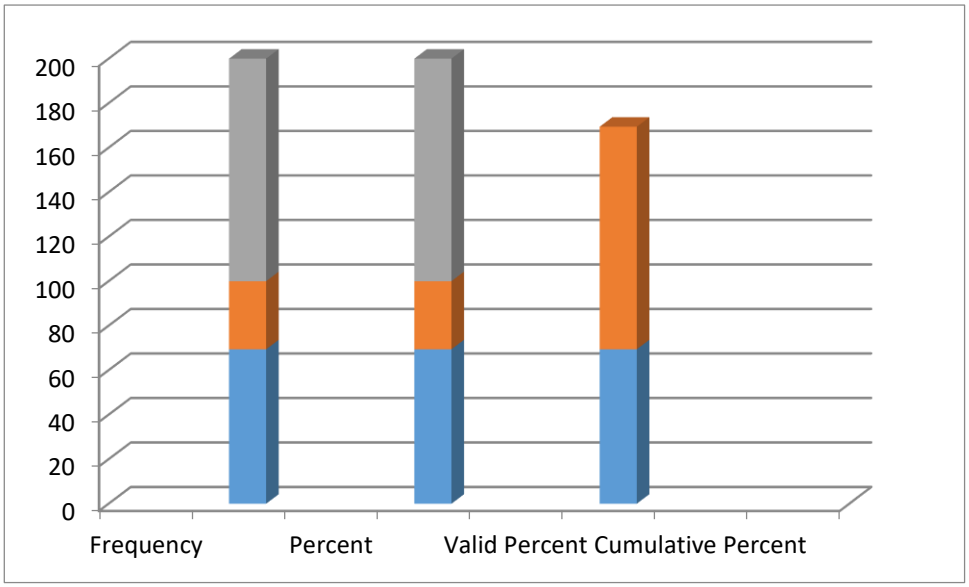
RESULT

A total of 98 participants are included in the sample.69.4% of the participants are female, while 30.6% are male.

5.1 Distribution of Gender

	Frequency	Percent	Valid Percent	Cumulative Percent
FEMALE	68	69.4	69.4	69.4
MALE	30	30.6	30.6	100.0
Total	98	100.0	100.0	

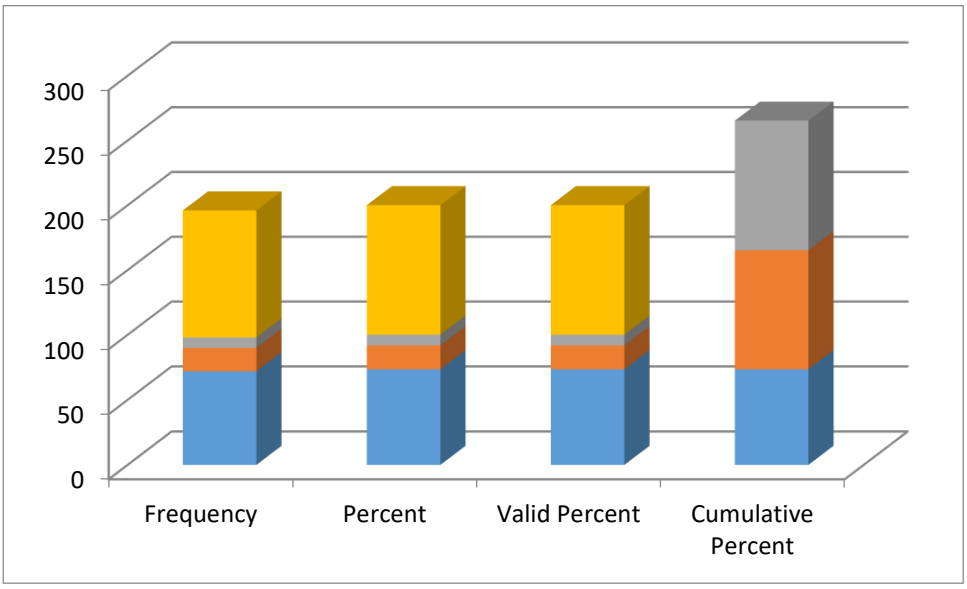
Table no. 1. A total of 98 participants are included in the sample. 69.4% of the participants are female, while 30.6% are male. There are no missing data, and the totals add up to 100%.



According the graph-1 the 69.4% of the participants are female, while 30.6% are male. There are no missing data, and the totals add up to 100%.

5.2 Age group distribution	Frequency	Percent	Valid Percent	Cumulative Percent
20-30 YRS	72	73.5	73.5	73.5
31-40 YRS	18	18.4	18.4	91.8
41-50 YRS AND ABOVE	8	8.2	8.2	100.0
Total	98	100.0	100.0	

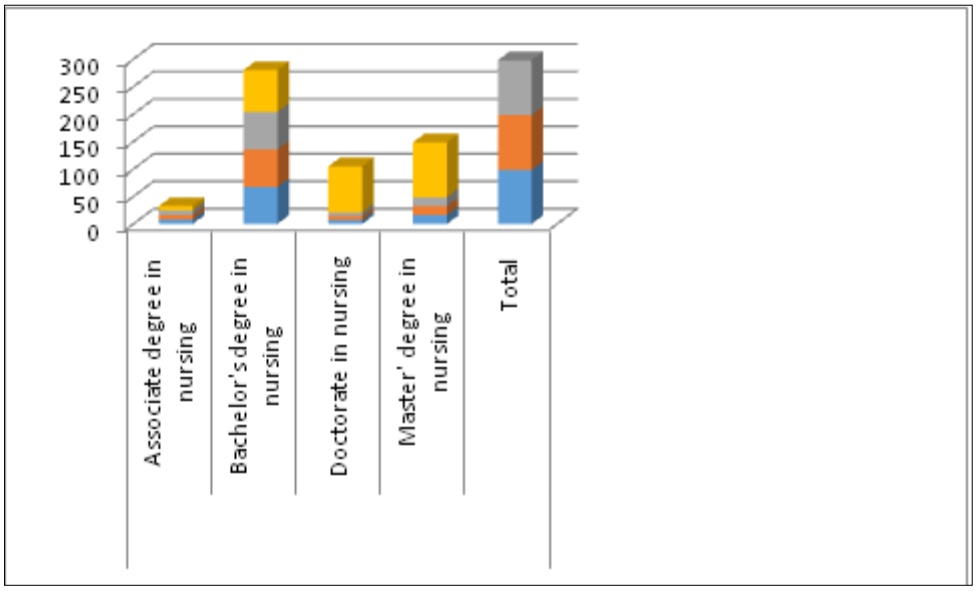
Table no.2. The majority of participants are in the 20-30 year age group (73.5%).A smaller portion of participants falls in the 31-40 year age group (18.4%).The smallest group is aged 41 years and above, representing only 8.2% of participants.



According the graph-5.2. The majority of participants are in the 20-30 year age group (73.5%).A smaller portion of participants falls in the 31-40 year age group (18.4%).The smallest group is aged 41 years and above, representing only 8.2% of participants.

5.3 .EDUCATION					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Associate degree in nursing	8	8.2	8.2	8.2
	Bachelor's degree in nursing	67	68.4	68.4	76.5
	Doctorate in nursing	7	7.1	7.1	83.7
	Master' degree in nursing	16	16.3	16.3	100.0
	Total	98	100.0	100.0	

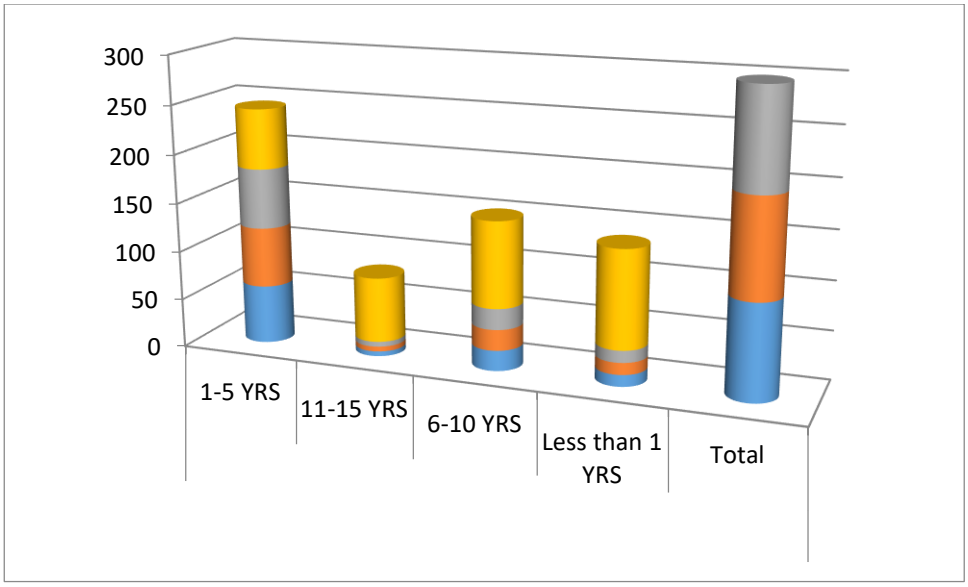
Table no.3. In summary, most of the individuals in the sample (68.4%) hold a Bachelor's degree in nursing. A smaller percentage holds either an Associate degree (8.2%), Doctorate (7.1%), or Master's degree (16.3%). The total count of the sample is 98 individuals. The cumulative percentage indicates that 83.7% of the individuals hold qualifications up to the Doctorate level, with the final 16.3% being those who hold a Master's degree.



Graph 5.3 : The majority of the sample (68.4%) possess a Bachelor's degree in nursing, while smaller percentages hold an Associate degree (8.2%), a Doctorate (7.1%), or a Master's degree (16.3%). In total, there are 98 participants, with 83.7% holding qualifications up to the Doctorate level and the remaining 16.3% holding a Master's degree."

5.4 EXPERIENCE				
	Frequency	Percent	Valid Percent	Cumulative Percent
1-5 YRS	60	61.2	61.2	61.2
11-15 YRS	5	5.1	5.1	66.3
6-10 YRS	21	21.4	21.4	87.8
Less than 1 YRS	12	12.2	12.2	100.0
Total	98	100.0	100.0	

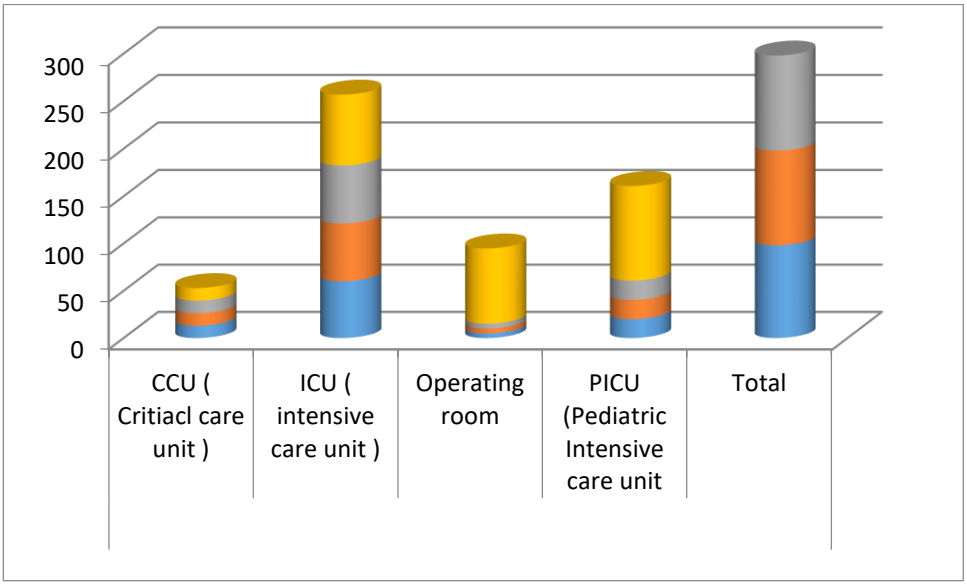
Table no.4. The majority of respondents (61.2%) have 1-5 years of experience. A smaller group (12.2%) has less than 1 year of experience.21.4% have 6-10 years of experience.



Graph :5.4. The majority of respondents (61.2%) have 1 to 5 years of experience, with a smaller percentage (12.2%) having less than 1 year. Additionally, 21.4% of respondents have 6 to 10 years of experience.

5.5 CURRENT UNIT OF EMPL0YMENT				
	Frequency	Percent	Valid Percent	Cumulative Percent
CCU (Critiacl care unit)	13	13.3	13.3	13.3
ICU (intensive care unit)	60	61.2	61.2	74.5
Operating room	5	5.1	5.1	79.6
PICU (Pediatric Intensive care unit	20	20.4	20.4	100.0
Total	98	100.0	100.0	

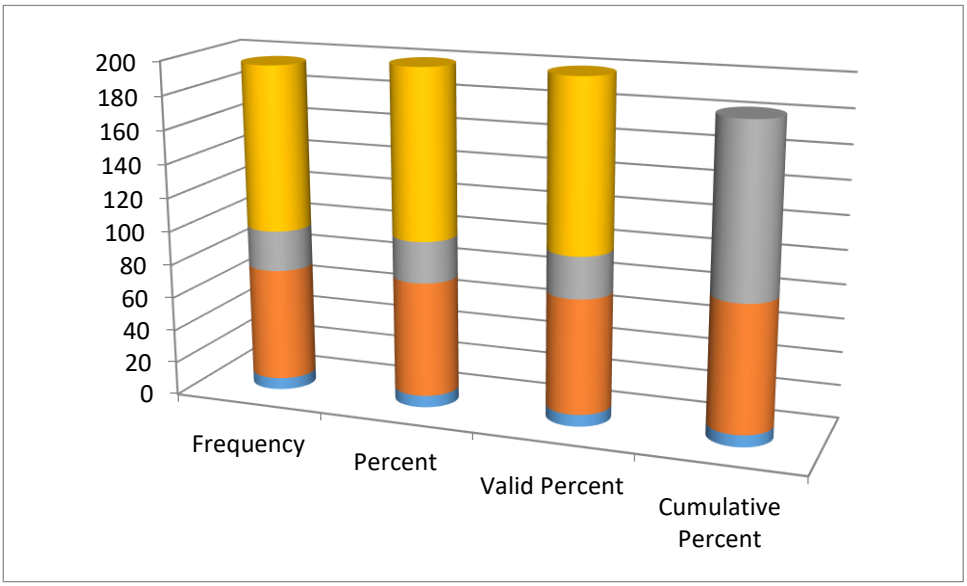
Table no.5. The majority of respondents (61.2%) are working in the ICU.A notable portion (20.4%) are employed in the PICU.CCU (13.3%) and Operating Room (5.1%) have fewer participants.This shows that the ICU is the most common unit of employment, followed by the PICU, with fewer respondents working in CCU or Operating Room settings.



Graph 5.5 : The chart shows that most of respondents, at 61.2%, are utilized in the ICU, making it the most widely recognized work setting. The PICU represents 20.4% of respondents, while the CCU and Working Room have more modest offers, at 13.3% and 5.1% separately. This outlines that the ICU is the essential area of work, trailed by the PICU, with less people in the CCU and Working Room.

5.6 TYPE OF HOSPITAL				
	Frequency	Percent	Valid Percent	Cumulative Percent
Military	7	7.1	7.1	7.1
private	67	68.4	68.4	75.5
Public	24	24.5	24.5	100.0
Total	98	100.0	100.0	

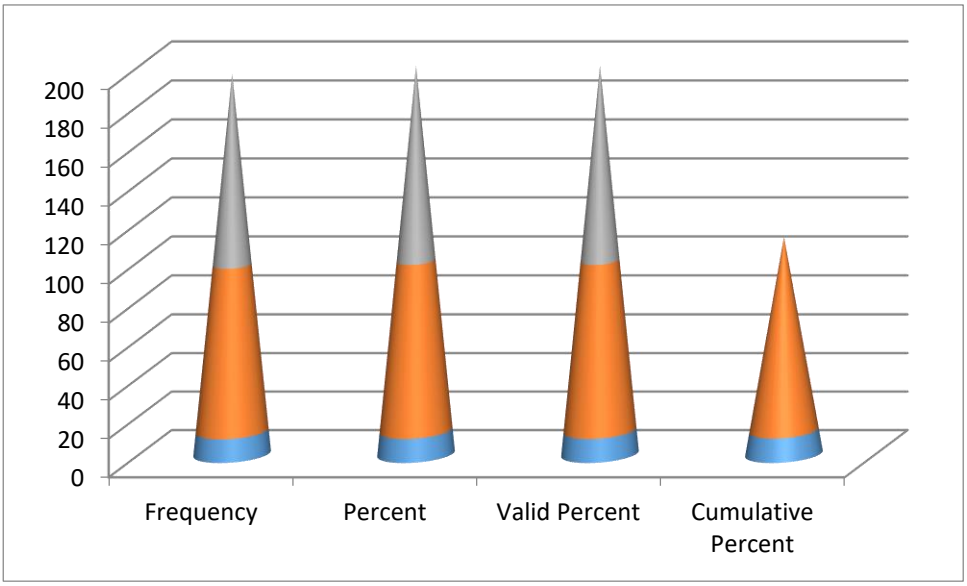
Table no.5.6. The majority of respondents (68.4%) work in Private Hospitals.Public Hospitals account for 24.5% of the respondents.Only a small group (7.1%) works in Military Hospitals.This data indicates that Private Hospitals are the most common employer for the participants in this study, followed by Public Hospitals, with fewer participants working in Military Hospitals.



Graph 5.6: The graph indicates that a significant majority of respondents (68.4%) are employed in private hospitals, establishing them as the primary employer. Public hospitals account for 24.5% of respondents, while only a small fraction (7.1%) work in military hospitals. This demonstrates that private hospitals are the most common workplace, followed by public hospitals, with military hospitals having the lowest number of participants.

5.7. Have you received formal training in radiation safety ?				
	Frequency	Percent	Valid Percent	Cumulative Percent
NO	12	12.2	12.2	12.2
YES	86	87.8	87.8	100.0
Total	98	100.0	100.0	

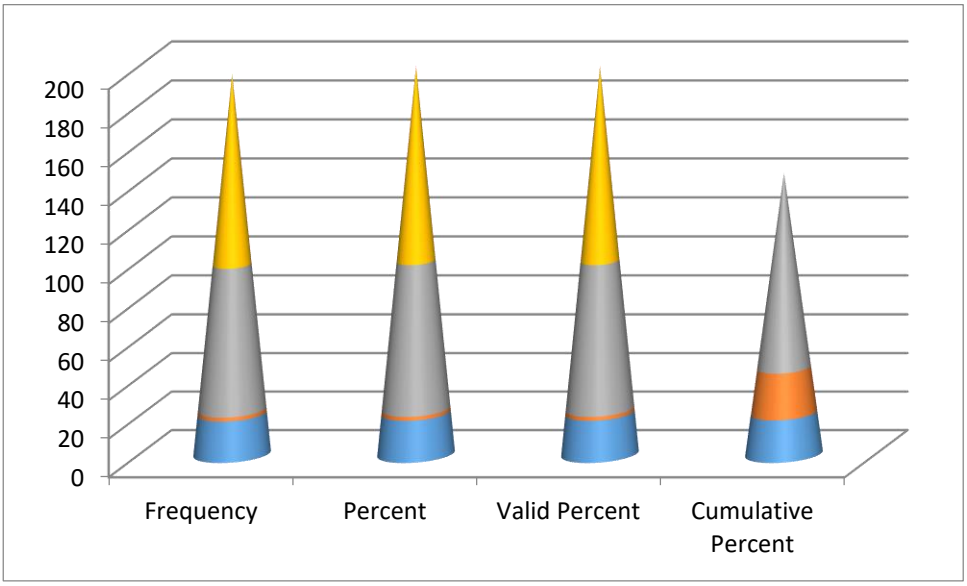
Table no.5.7. The majority (87.8%) of respondents have received formal training in radiation safety. A minority (12.2%) have not received such training. These results reflect a high level of formal radiation safety training among the group surveyed, with nearly 9 out of 10 respondents reporting that they have undergone the training.



Graph 5.7 : The graph shows that a substantial majority of respondents (87.8%) have completed formal training in radiation safety, while a smaller group (12.2%) has not. These findings indicate a strong prevalence of formal radiation safety training among the participants, with nearly 9 out of 10 confirming their completion of the training.

5.8 if yes, when was your last training?				
	Frequency	Percent	Valid Percent	Cumulative Percent
1-3 years ago	21	21.4	21.4	21.4
3-5 years ago	2	2.0	2.0	23.5
less than 1 years ago	75	76.5	76.5	100.0
Total	98	100.0	100.0	

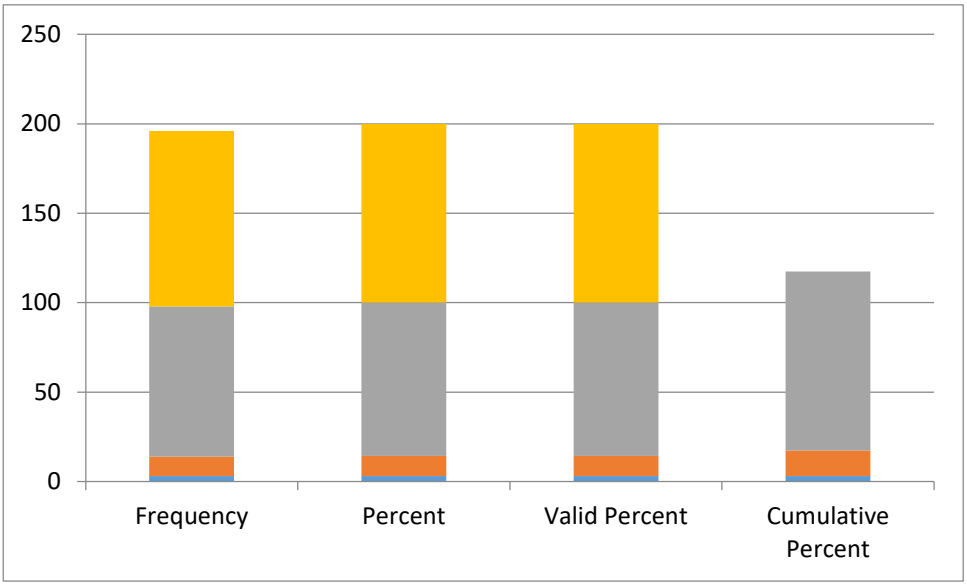
Table no.5.8 The majority of respondents (76.5%) have had radiation safety training within the past year.A smaller group (21.4%) had training 1-3 years ago.Only 2% of respondents reported having their last training 3-5 years ago.This suggests that a large proportion of the respondents are up to date with recent radiation safety training.



Graph 5.8 : The graph reveals that most respondents (76.5%) have undergone radiation safety training in the past year, while a smaller percentage (21.4%) completed their training 1 to 3 years ago. Only 2% reported their last training as occurring 3 to 5 years ago. This indicates that a significant number of respondents are current with their radiation safety training.

5.9.Knowledge of the ALARA(as low as reasonably achievable)principle?				
	Frequency	Percent	Valid Percent	Cumulative Percent
Not knowledgeable	3	3.1	3.1	3.1
Somewhat knowledgeable	11	11.2	11.2	14.3
very knowledgeable	84	85.7	85.7	100.0
Total	98	100.0	100.0	

Table no.5.9. The overwhelming majority (85.7%) of respondents are very knowledgeable about the ALARA principle.A smaller group (11.2%) consider themselves somewhat knowledgeable.Only 3.1% of respondents are not knowledgeable about the ALARA principle.This indicates a high level of awareness and understanding of radiation safety practices among the surveyed group.

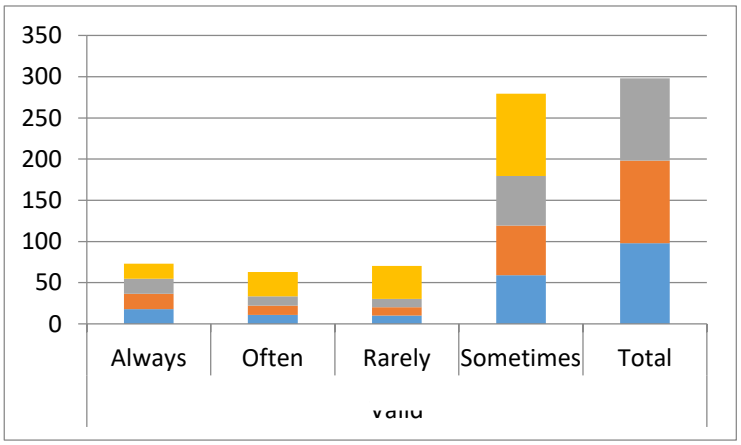


Graph 5.9: The survey results reveal that a significant majority (85.7%) of respondents are very knowledgeable about the ALARA principle, while 11.2% consider themselves somewhat knowledgeable, and only 3.1% lack knowledge about it. This suggests a strong awareness of radiation safety practices among the group surveyed.

5.10.How often do you adhere to radiation safety guidelines provided by your institution?

	Frequency	Percent	Valid Percent	Cumulative Percent
Always	18	18.4	18.4	18.4
Often	11	11.2	11.2	29.6
Rarely	10	10.2	10.2	39.8
Sometimes	59	60.2	60.2	100.0
Total	98	100.0	100.0	

Table no.5.10. A majority (60.2%) of respondents sometimes adhere to radiation safety guidelines.18.4% of respondents always follow the guidelines.11.2% often adhere to the safety measures.A small percentage (10.2%) rarely follow the guidelines.

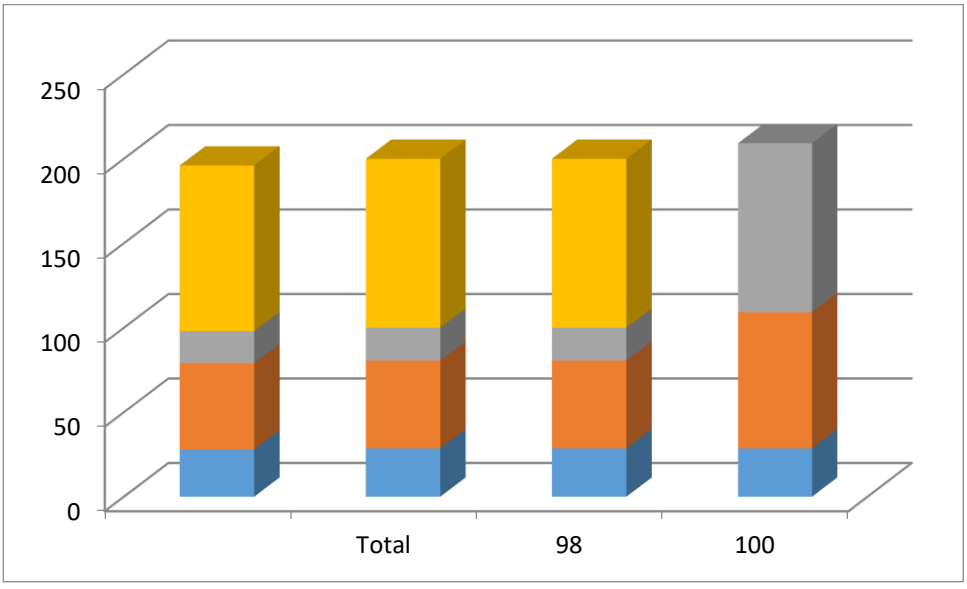


Graph 5.10: The results indicate that a majority of respondents (60.2%) sometimes follow radiation safety guidelines. Meanwhile, 18.4% always adhere to the guidelines, 11.2% often comply, and a smaller proportion (10.2%) rarely follows them.

5.11.How confident are you in your ability to minimize radiation exposure to yourself and patients?

	Frequency	Percent	Valid Percent	Cumulative Percent
Netural	28	28.6	28.6	28.6
Somewhat confident	51	52.0	52.0	80.6
Very confident	19	19.4	19.4	100.0
Total	98	100.0	100.0	

Table no. 5.11. The data shows that the majority (45.9%) of respondents do not believe the radiation safety training is adequate, while a smaller portion (17.3%) agrees that it is, and a significant portion remains neutral (36.7%).The findings suggest that there is considerable room for improvement in radiation safety training as nearly half of the participants are dissatisfied with the current state of training. The total number of participants in the study is 98, with the following key cumulative percentages:After accounting for "neutral" responses, 28.6% of participants fall into this category.With the addition of the "somewhat confident" group, the cumulative percentage reaches 80.6%.Finally, the "very confident" group completes the distribution at 100%.These findings show that a majority of participants are at least somewhat confident in their ability to manage radiation exposure, while a smaller portion are very confident.



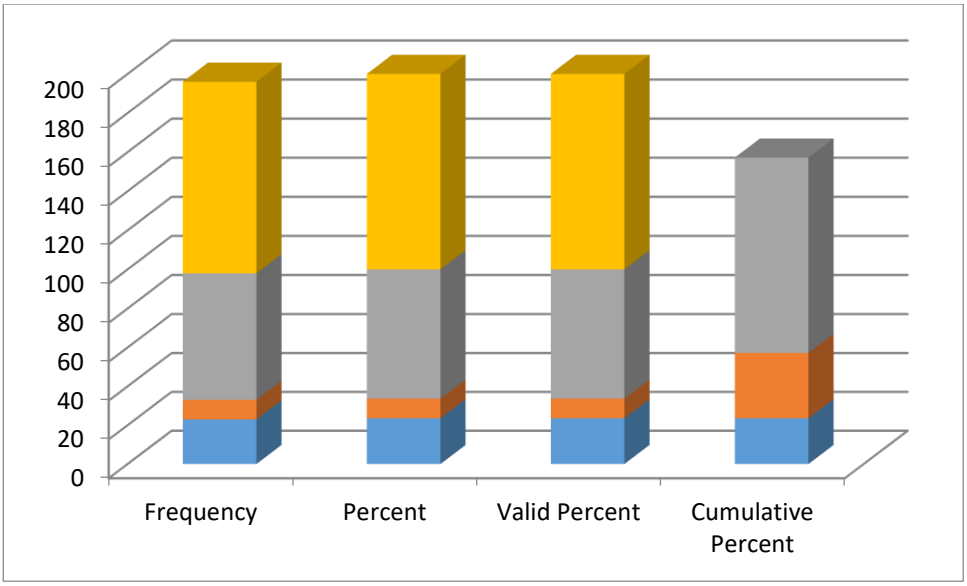
Graph 5.11. The results indicate that a significant majority (45.9%) of respondents feel that radiation safety training is insufficient, while only 17.3% find it adequate, and 36.7% are neutral. This highlights a clear need for improvement, as nearly half of the participants are dissatisfied with the training. Among the 98 participants, 28.6% fall into the neutral category, and when including those who are "somewhat confident," the cumulative percentage rises to 80.6%. The remaining participants are

classified as "very confident," completing the distribution. Overall, most respondents express at least some level of confidence in managing radiation exposure, though fewer are very confident.

5.12.Do you think the current radiation safety policies at your institution are sufficient?

	Frequency	Percent	Valid Percent	Cumulative Percent
No	23	23.5	23.5	23.5
Unsure	10	10.2	10.2	33.7
Yes	65	66.3	66.3	100.0
Total	98	100.0	100.0	

Table no.5.12.The total number of participants is 98, with the following cumulative percentages:23.5% of respondents believe the policies are insufficient.Including the "unsure" group, the cumulative percentage reaches 33.7%.The remaining 66.3% are confident that the current policies are sufficient, bringing the total to 100%.Overall, the majority of participants view the existing radiation safety policies as adequate, though a notable minority either disagree or are uncertain.

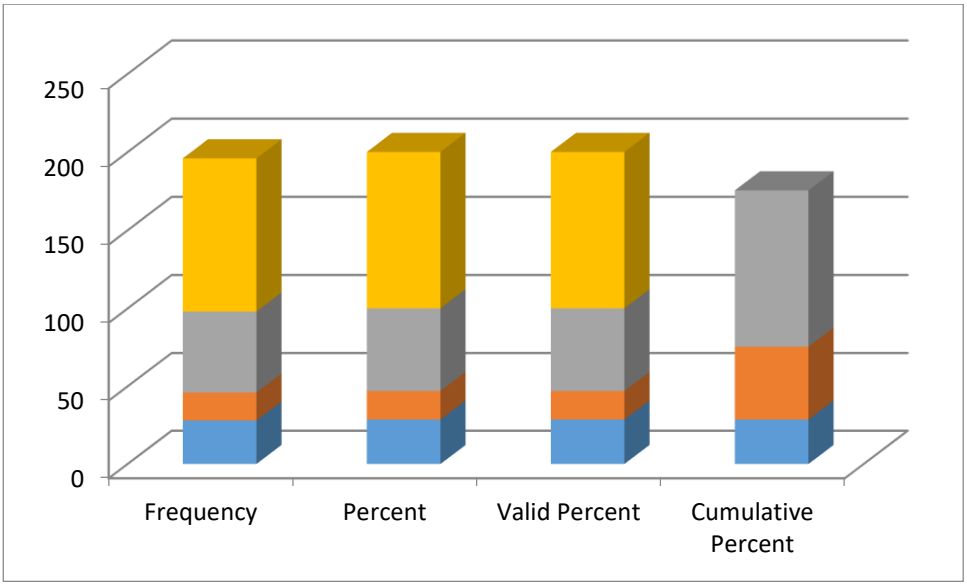


Graph 5.12. The survey involved 98 participants, with cumulative percentages showing that 23.5% feel the policies are inadequate. When adding the "unsure" group, the total reaches 33.7%. This means that 66.3% of respondents are confident that the current policies are sufficient, completing the total at 100%. Overall, while most participants consider the existing radiation safety policies adequate, a noteworthy minority either disagree or remain uncertain.

5.13.How often do you use presonal protective equipment during portable radiography in the ICU/CCU/PICU/Oprating room?

	Frequency	Percent	Valid Percent	Cumulative Percent
Always	28	28.6	28.6	28.6
Often	18	18.4	18.4	46.9
Sometimes	52	53.1	53.1	100.0
Total	98	100.0	100.0	

Table no.5.13.The total number of participants is 98, with the following cumulative percentages:28.6% of participants always use PPE.With the addition of those who often use PPE, the cumulative percentage reaches 46.9%.Including the participants who sometimes use PPE brings the cumulative percentage to 100%.These results show that while some participants consistently use PPE, a significant portion either use it often or only sometimes, indicating room for improvement in compliance with protective measures.

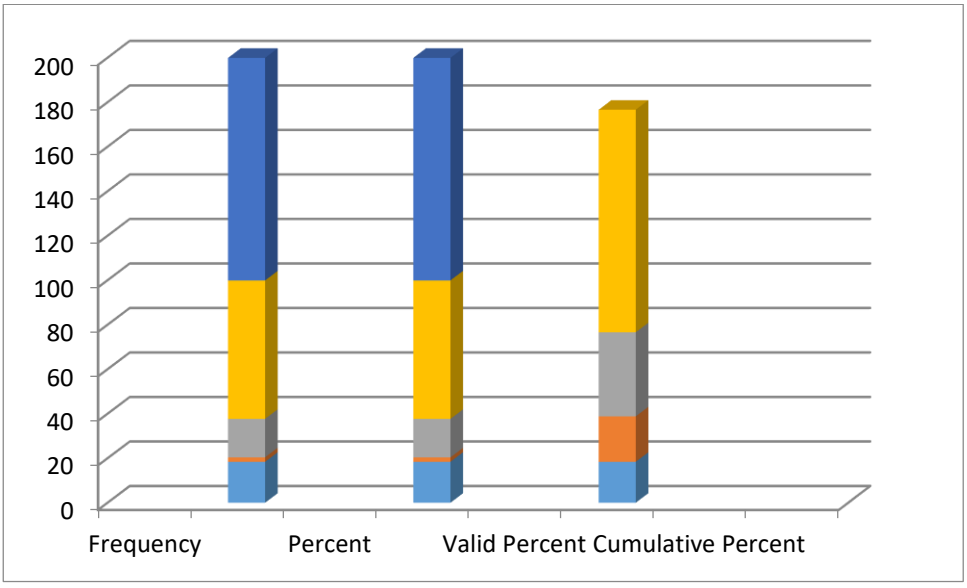


Graph 5.13. A sum of 98 members were overviewed, with total rates demonstrating that 28.6% consistently utilize individual defensive gear (PPE). At the point when the people who frequently use PPE are incorporated, the rate increases to 46.9%. Adding members who in some cases use PPE finishes the complete at 100 percent. That's what these discoveries feature, albeit a few respondents reliably use PPE, an impressive number use it either frequently or just once in a while, recommending there is potential for further developing consistence with defensive measures.

5.14.Do you feel that the operating environment affects your adherence to radiation safety protocols?

	Frequency	Percent	Valid Percent	Cumulative Percent
	18	18.4	18.4	18.4
note sure	2	2.0	2.0	20.4
Sometimes	17	17.3	17.3	37.8
Yes	61	62.2	62.2	100.0
Total	98	100.0	100.0	

Table no.5.14.The total number of participants is 98, with the following cumulative percentages:18.4% of respondents do not think the environment affects their adherence.Including the "not sure" group brings the cumulative percentage to 20.4%.Adding those who believe it sometimes affects their adherence raises the cumulative percentage to 37.8%.Finally, 62.2% of respondents feel that the environment does affect their adherence, bringing the total to 100%.Overall, the majority of participants believe that the operating environment influences their ability to adhere to radiation safety protocols.

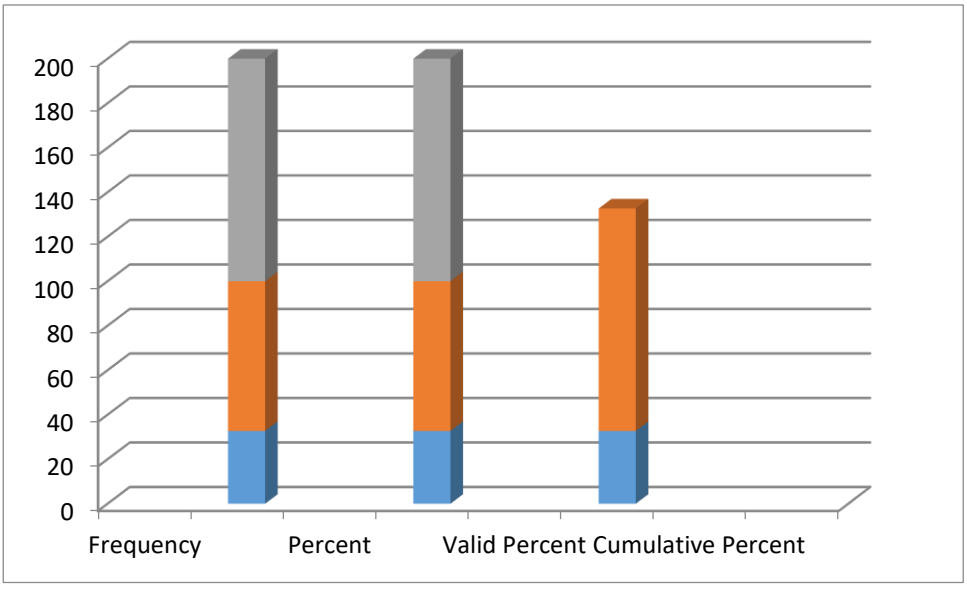


Graph5.14. The overview included 98 members, with combined rates showing that 18.4% don't really accept that the climate influences their adherence to somewhere safe and secure conventions. Counting the individuals who are "don't know" raises this rate to 20.4%. While adding members who feel the climate some of the time influences their adherence, the all out comes to 37.8%. At last, 62.2% of respondents accept that the climate impacts their adherence, finishing the complete at 100 percent. Generally, most members feel that their working climate influences their capacity to follow radiation security conventions.

5.15.Have you ever experienced or witnessed any radiation over-exposure incidents in your unit?

		Frequency	Percent	Valid Percent	Cumulative Percent
		32	32.7	32.7	32.7
	Yes	66	67.3	67.3	100.0
	Total	98	100.0	100.0	

Table no. 5.15.The total number of participants is 98, with the following cumulative percentages:32.7% of respondents report no overexposure incidents.67.3% of respondents indicate they have experienced or witnessed radiation overexposure, bringing the cumulative percentage to 100%.This suggests that radiation overexposure incidents are relatively common, with two-thirds of participants having encountered them in their units.

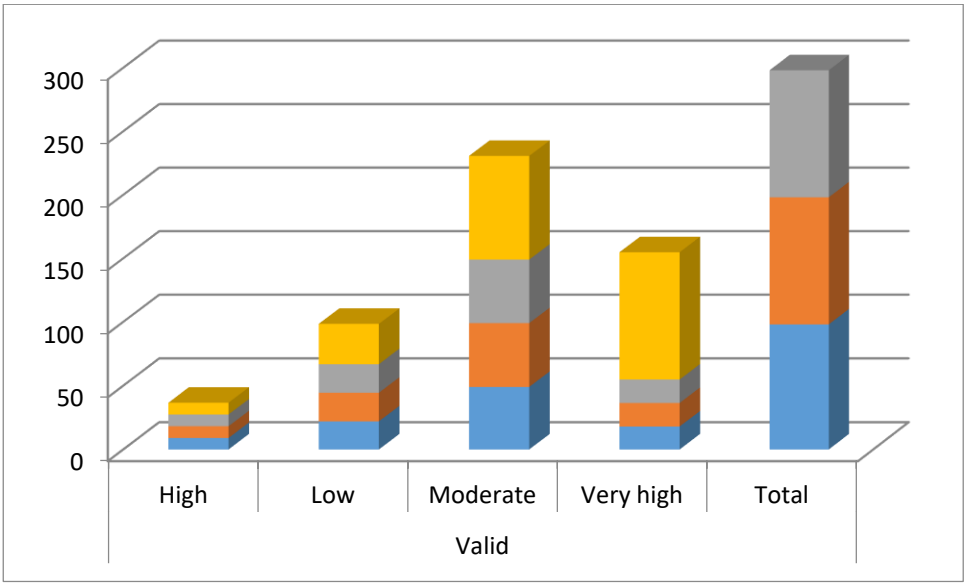


Graph5.15. The study included 98 members, with aggregate rates demonstrating that 32.7% report no episodes of overexposure. On the other hand, 67.3% have encountered or seen radiation overexposure, finishing the all out at 100 percent. This proposes that occurrences of radiation overexposure are somewhat normal, as 66% of members have experienced such cases in their units.

5.16.Rate the level of radiation safety awareness among your colleagues?

	Frequency	Percent	Valid Percent	Cumulative Percent
High	9	9.2	9.2	9.2
Low	22	22.4	22.4	31.6
Moderate	49	50.0	50.0	81.6
Very high	18	18.4	18.4	100.0
Total	98	100.0	100.0	

Table no. 5.16. The total number of participants is 98, with the following cumulative percentages:9.2% of respondents rate the awareness as high.Including those who consider it low, the cumulative percentage reaches 31.6%.With the addition of those rating it as moderate, the cumulative percentage rises to 81.6%.Finally, 18.4% rate awareness as very high, bringing the total to 100%.Overall, most participants rate their colleagues' radiation safety awareness as moderate, with a smaller portion rating it either very high or low.

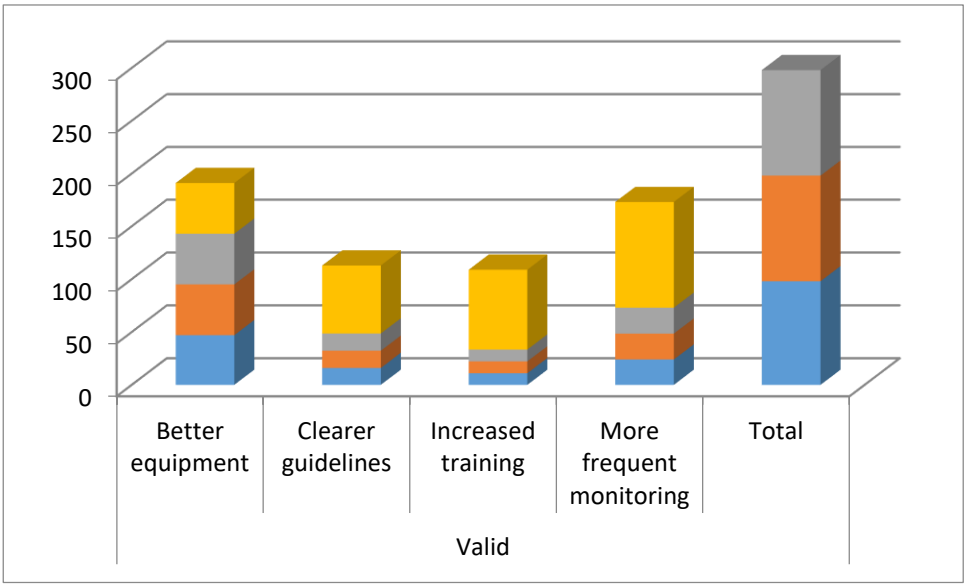


Graph5.16. The review included 98 members, with total rates showing that 9.2% rate their partners' radiation security mindfulness as high. While adding the people who think of it as low, the all out increments to 31.6%. Counting members who rate mindfulness as moderate raises the aggregate rate to 81.6%. Finally, 18.4% rate mindfulness as exceptionally high, finishing the all out at 100 percent. Generally speaking, most members view their partners' radiation wellbeing mindfulness as moderate, with less appraising it as exceptionally high or low.

5.17.What additional measures do you think are necessary to improve radiation safety in your unit?

	Frequency	Percent	Valid Percent	Cumulative Percent
Better equipment	47	48.0	48.0	48.0
Clearer guidelines	16	16.3	16.3	64.3
Increased training	11	11.2	11.2	75.5
More frequent monitoring	24	24.5	24.5	100.0
Total	98	100.0	100.0	

Table no.5.17.The total number of participants is 98, with the following cumulative percentages:48.0% of respondents believe better equipment is the key improvement needed.Including those who recommend clearer guidelines brings the cumulative percentage to 64.3%.With the addition of those suggesting increased training, the cumulative percentage reaches 75.5%.Finally, 24.5% of participants advocate for more frequent monitoring, bringing the cumulative percentage to 100%.

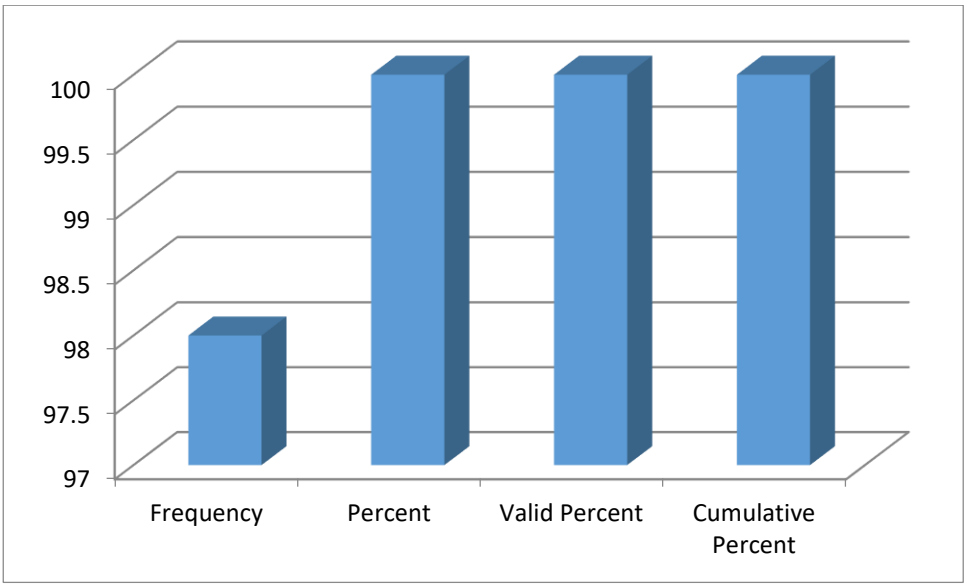


Graph5.17. The absolute number of members is 98, and the key improvement needs are as per the following: 48.0% of respondents distinguished better gear as fundamental. Counting those recommending more clear rules raises the aggregate rate to 64.3%. Adding the individuals who favor expanded preparing carries it to 75.5%. At last, 24.5% of members suggest more regular checking, bringing about a sum of 100 percent.

5.18. what challenges do you face in adhering to radiation safety protocols in your unit?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	98	100.0	100.0	100.0

Table no.5.18.The research results indicate that 100% of participants (98 out of 98) reported facing no challenges in adhering to radiation safety protocols in their unit.This suggests that all participants feel they are able to follow the radiation safety protocols without any difficulties

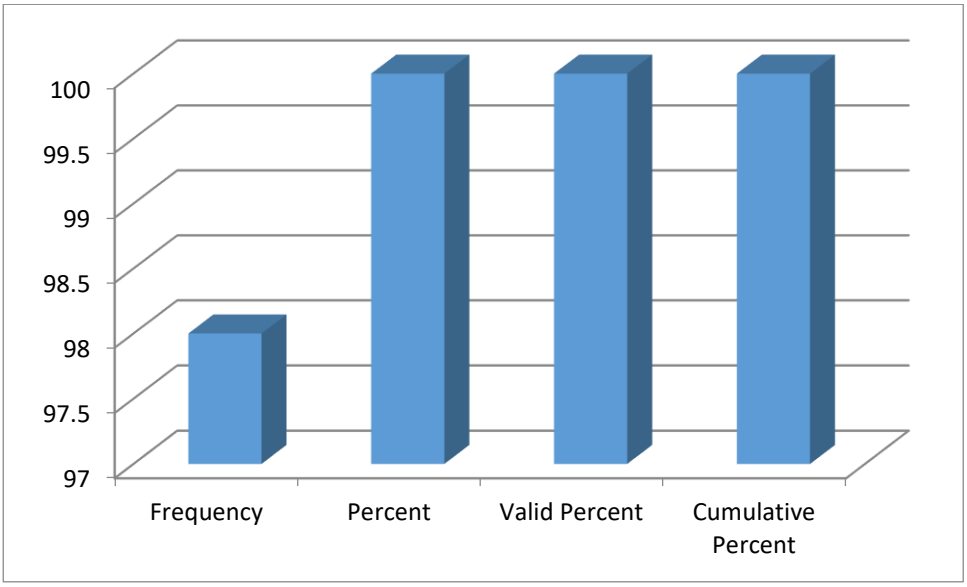


Graph5.18. All members (98 out of 98) demonstrated that they confronted no difficulties in following radiation wellbeing conventions, proposing full consistence and trust in their capacity with comply to these rules.

5.19.in your optio, what improvement can be made to radiation safety training programs?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	98	100.0	100.0	100.0

Table no.5.19.The research results show that 100% of participants (98 out of 98) did not suggest any improvements to radiation safety training programs, indicating that all respondents either find the current programs satisfactory or chose not to provide input on this question.This suggests there are no reported concerns or suggestions for improvement regarding the radiation safety training programs based on this data.

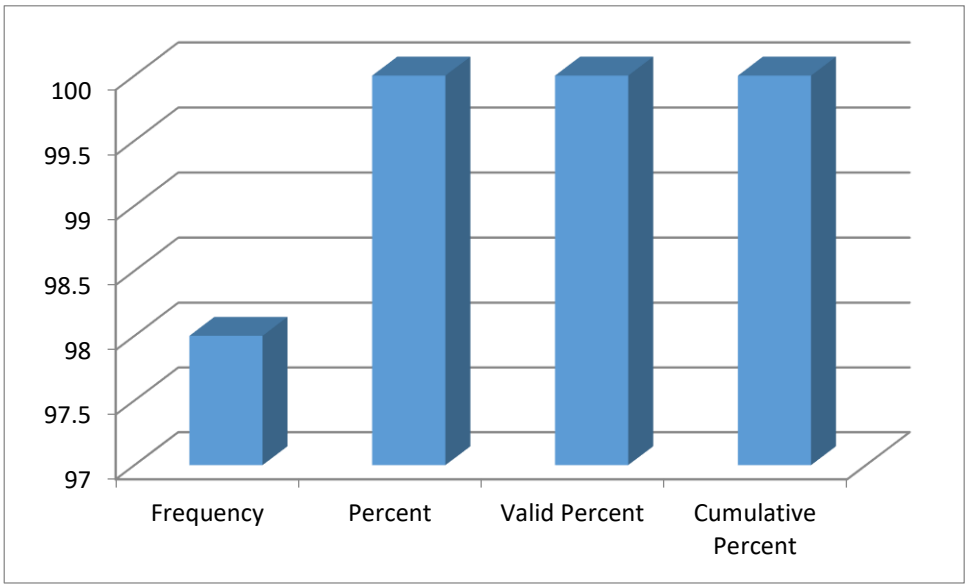


Graph5.19. All members (98 out of 98) recommended no enhancements to radiation security preparing programs, showing that they either find the ongoing projects agreeable or decided not to give input. This proposes no worries or proposals for development in view of the information.

5.20. Please shere any additional comments or suggestion regarding radiation safety and protection in your workplace

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	98	100.0	100.0	100.0

Table no.5.20.The research results indicate that 100% of participants (98 out of 98) did not provide any additional comments or suggestions regarding radiation safety and protection in their workplace. This suggests that there are no further insights or concerns expressed by the respondents on this topic, either due to satisfaction with the current practices or a lack of input.



Graph5.20. All members (98 out of 98) gave no extra remarks or ideas in regards to radiation wellbeing and security in their work environment. This demonstrates that there could be no further experiences or concerns communicated, reasonable because of fulfillment with current practices or an absence of info.

DISCUSSION

All in all, while the review has a greater part of members in the 20-30 age bunch, the more modest representation from more seasoned age gatherings ought to be painstakingly viewed as in the examination and translation of results, particularly while going for the gold comprehension across age socioeconomics. This study investigated the connections between information about radiation security, demeanor towards radiation insurance, and radiation assurance ways of behaving among emergency room nurture and dissected the elements affecting radiation security ways of behaving. Along these lines, the goal of the review was to plan fundamental data for supporting the improvement of instructive projects to shield emergency room medical attendants from radiation exposure and reinforce the radiation assurance ways of behaving of trauma center medical caretakers. The significant ramifications of the review results are examined underneath. This disparity between the discoveries of the referenced review and those of our review can be because of the radiographers' by and large distance from scholastic training, the absence of relentless examinations, as well as the inaccessibility of adequate schooling offices for the radiographers in the previously mentioned study. In expansion, the discoveries showed that there was a connection between the radiographers' scholarly degree and their familiarity with the radiation security, i.e., the all-out mindfulness scores expanded by higher scholarly degree. At the end of the day, the radiographers with higher scholastic degrees had less radiation openness than those with lower degrees because of better acknowledgment of the radiation insurance rules. Hence, it appears to be that proceeding with schooling is fundamental for the radiographers. In this examination conversation, the information proposes that most members see their associations' radiation wellbeing mindfulness as being at a moderate level. This is proven by the aggregate level of 81.6% while adding the reactions that rate mindfulness as moderate to the others. A more modest level of members see the mindfulness as exceptionally high (18.4%) or low (31.6%). The breakdown uncovers a few experiences: The consequences of this study showed that just 47.7% of the participants had the option to fathom the idea of ALARA, in spite of the fact that it is the essential standard of radiation security. Almost 88% of the doctors knew about the essential ideas of radiological supportive of cedars as an essential rule of the patients' radiation protection. [15] This finding affirms the ICRP reports communicating that a few radiological techniques are endorsed without adequate justification. [15] Besides, 8.8% of the MPs had some awareness of the ICRP portion limit (a basic piece of most radiation security programs) and the way that the reason for individual radiation observing is to guarantee that as far as possible are not exceeded. The larger part of members accept that the working climate assumes a critical part in their capacity to follow radiation wellbeing conventions. This proposes that any endeavors to further develop radiation wellbeing shouldn't just zero in on individual preparation yet additionally on advancing the actual workplace—whether through superior format, gear access, or other natural factors that can uphold better adherence to somewhere safe and secure norms. The information on radiation security among ICU staff is for the most part deficient, with concentrates on showing low or normal information levels and a huge extent scoring beneath good grades on evaluations. This absence of information is seen across ICU staff gatherings; however, nurses and RTs will generally have less information than doctors and radiographers (Almalki et al., 2021). A few variables impact radiation insurance information, including schooling level, earlier significant preparation, openness to radiation security writing, and long periods of clinical experience (Sharafi, 2018). The discoveries of a survey of 41 investigations of medical services laborers uncovered that in most studies, over a portion of the members had just normal information about radiation security, while 60% showed an uplifting outlook towards it. In any case, regardless of this positive attitude, their genuine act of radiation security measures was normally.

CONCLUSION

The review presumes that while some ICU medical caretakers have a sensible comprehension of radiation security, there are critical information holes and social irregularities that should be tended to. Call for Action The discoveries feature the requirement for designated mediations, including further developed preparation, better security conventions, and standard appraisals to improve radiation wellbeing rehearses in all in all. While this concentrate overwhelmingly included members from the 20-30 age bunch, the more modest portrayal of more seasoned standard participants should be thought about while breaking down the outcomes. This restriction ought to be remembered while intending to sum up discoveries across various age socioeconomics. The review investigated the connection between information, perspectives, and ways of behaving with respect to radiation assurance among trauma center medical attendants and distinguished key facets that impact their defensive ways of behaving. These discoveries can act as fundamental information to advise the improvement regarding instructive projects pointed toward decreasing radiation openness among emergency room nurses and working on their adherence to somewhere safe and secure protocols. Notably, the errors saw between this review and earlier research might be credited to a few variables, including the scholarly climate and the accessibility of educational assets for radiographers in past examinations. The discoveries additionally show that radiographers with higher scholastic degrees would be advised to pay attention to radiation insurance standards, for example, the ALARA concept, and were more averse to being presented to hurtful radiation because of their expanded information. This underscores the significance of progressing training for radiographers. Additionally, the review uncovers that many standard participants evaluated their partners' familiarity with radiation security at a moderate level, featuring an expected region for development. A basic understanding from this examination is the acknowledgment that upgrading radiation wellbeing conventions should stretch out past individual preparation and remember enhancements for the working climate to help better compliance. Overall, the deficient degrees of radiation security information among medical services laborers, including ICU staff, present dangers to both staff and patients. Factors, for example, schooling level, preparation, and clinical experience fundamentally impact information and conduct. In spite of a for the most part uplifting outlook towards radiation wellbeing, genuine practices frequently stay lacking, supporting the requirement for exhaustive training and natural improvements to advance successful radiation security rehearses.

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ANNEXURES

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INFORMED CONSENT ENGISH

NAME OF RESEARCHER: SIKEDER KUMAR (MMIT, Post graduate student)

[E-mail; sikenderkumar21092000@gmail.com] [Contact: 7295984558]

I…….. voluntary agree to participate in this research study

"ICU NURSES' KNOWLEDGE OF RADIATION SAFETY AND THEIR BEHAVIOR TOWARDS PORTABLE RADIOLOGICAL EXAMINATIONS"

- I understand that even if I agree to participate now, I can withdraw at any time or refuse to answer any question without any consequences of any kind.
- The purpose and nature of the study is explained to me and also had the opportunity to ask question about the study .
- I understand that will not receive any benefits for participating in this research.
- My identity will remain anonymous. This will be done by changing my name and disguising any details of my interview which many reveal may identity of people I speak about.
- In case of participant's inability to read: The researcher has done accurate reading of the consent form to the potential participant, and individual has had the opportunity to ask questions.

---------- ----------

Signature /Thumb print of research participant Date

Signature of researcher

Tasks	Tasks Duration	Start Date	End Date	Aug-Sep	Oct-Nov	Dec-Jan	Feb-Mar	Apr-May	Jun-Jul	Aug-Sep
Preparation of thesis proposal	21	15-07-23	05-08-23							
Presentation of thesis proposal	25	05-08-23	30-08-23							
Preparation & Submission Thesis Application in Ethics Committee	41	30-08-23	10-10-23							
Review of Literature	89	10-10-23	07-01-24							
Data Collection	80	17-05-24	24-05-24							
Data Analysis	7	05-09-24	19-09-24							
Finding & Rec-ommendations	10	20-09-24	27-09-24							
Report Writing	30	01-08-24	27-09-24							
Submission of thesis	5	30-08-24	03-10-24							
Presentation of thesis	0									

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F. No. SU/R/2024/1344[50] Dated: 17.05.2024

Subject: Grant of Ethical Clearance for **Dissertation Protocol** Topic **"ICU Nurses Knowledge of Radiation Safety and Their Behaviors Towards Portable Radiological Examinations",** submitted by **SIKENDER KUMAR,** student of M.Sc Medical Imaging Technology, 2022 Batch.

*****

With reference to the request for grant of Ethical Clearance for the Dissertation Protocol entitled **"ICU Nurses Knowledge of Radiation Safety and Their Behaviors Towards Portable Radiological Examinations"**, **SIKENDER KUMAR** is informed that the **Dissertation Protocol** submitted by him/her was considered by the **Screening Committee** of the **Allied Health Sciences** in its meetings held on 07.02.2024 and 29.02.2024. The recommendations of the **Screening Committee** were considered in detail by the **Institutional Ethics Committee** in its meeting held on **15.05.2024** and the same was **approved** by the **Ethics Committee** of the **Santosh Deemed to be University, Ghaziabad, Delhi NCR**.

He /She is informed accordingly for further necessary action.

17/5/24

[Dr. EZHILRAJAN. K]
REGISTRAR

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SIKENDER KUMAR
M.Sc Medical Imaging Technology.

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ICU Nurses Knowledge of Radiation Safety and Their Behaviours Towards Portable Radiological Examinations

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